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Initialled abstracts and reviews in this number are by H. Martin of the Long Ashton Research Station and by R. J. Garner, R. V. Harris, M. E. King, A. M. Massee, W. S. Rogers and H. Shaw of the East Malling Research Station.

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Horticultural Abstracts

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MISCELLANEOUS.

Publications.

793. AKENHEAD, D. 016 : 634/635
The information service of the Imperial Bureau of Horticulture and Plantation Crops.

Proc. Brit. Soc. int. Bibl., 1940, 1 : 17-24, bibl. 4.

A paper given at the Science Museum, London, in December, 1939 in which the aims, methods and work of the Imperial Bureau of Horticulture are briefly discussed. It is commended to the notice of any of our readers who are interested in but uncertain of our activities. A limited number of reprints are available free.

Plant hormones.*

794. CARPENTER, P. H. 577.15.04
Notes on "growth promoting substances".
Mem. Indian Tea Ass. Tocklai Exp. Stat. 9, 1939, pp. 12.

A brief, clear account of the more important work with plant hormones from 1914 up to the present day.

795. TINCKER, M. A. H. 577.15.04
Some root-forming substances, in relation to one another, to plant metabolism, and to growth.
Ann. appl. Biol., 1940, 27 : 184-95, bibl. 14.

The author has experimented at Wisley with a very large number of plants and chemicals. He summarizes as follows :—Tested on cuttings, indolylacetic acid and indolylbutyric acid are active growth substances. Several derivatives of tyrosine and histidine proved inactive, and from phenylalanine substances like phenylacetic and β -phenylpropionic acids possess low activity. Tetrahydronaphthylideneacetic acid, M.P. 92° C., is highly active, its isomeride less so. By the dehydration of tetralolacetic acid a useful active mixture is obtained. 2-phenanthryl and 3-phenanthrylacetic acid proved inactive, as did also cyclopentylideneacetic and fluorenylideneacetic. Growth substances when applied to seeds by soaking caused the resulting seedlings to be no heavier than those untreated. When applied to annuals at a wide range of concentration these substances produced no stimulus but only toxic effects at higher concentrations. Applied to bulbs the growth substances checked stem elongation. In unusual circumstances the growth substances may cause accelerated development of roots from bulbs. The relationship between certain amino-acids and some active growth substances is briefly discussed. Cell division is a prominent feature of the response shown by cuttings.

796. ZIMMERMAN, P. W., AND HITCHCOCK, A. E. 577.15.04
Adventitious shoots and roots induced by natural influences and synthetic growth substances.

Contr. Boyce Thompson Inst., 1940, 11 : 127-41, bibl. 19.

Experiments are described on *Amelosorbus Jackii*, *Pyrus Malus Niedzwetzkyana*, *Actinidia arguta*, *Althaea*, *Populus*, and *Elaeagnus* spp. and others in which the capacity of these plants to produce adventitious shoots and roots under natural influences and the effects of applying growth substances, mutilating the tissue and varying external conditions were tested. As an example of results *Althaea* cuttings produced many adventitious shoots along the disbudded stem in contrast to cuttings with normal buds intact. The application of well-known root-inducing

* See also 860, 925, 1066, 1067, 1107.

substances resulted in the production of roots instead of shoots. Treatment of disbudded cuttings with vapours of naphthalene and indole substances resulted in roots being formed from the upper, middle and lower regions, thus upsetting normal polarity. Other phenomena are discussed.

797. HITCHCOCK, A. E., AND ZIMMERMAN, P. W. 577.15.04

Effects obtained with mixtures of root-inducing and other substances.

Contr. Boyce Thompson Inst., 1940, 11 : 143-60, bibl. 8.

The root-inducing activities of mixtures of two or more substances were compared with those of individual substances. Successive treatments were also used. Water or talc were the chief carriers. In many, but not all cases, the mixtures were more effective on cuttings than any of the individual substances. This greater than additive effect was characterized by an increase in number of roots, a higher percentage of rooted cuttings, more uniform rooting, and other effects typical of a higher concentration of a root-inducing substance. Such effects were obtained with substances of different root-inducing activity but not with substances of about equal activity. All genera or species of cuttings did not respond equally well to a given mixture. Certain mixtures of IB (indolebutyric) and NA (α -naphthaleneacetic) were effective on IB- and NA-sensitive cuttings. Depending upon the kind of cutting and the conditions of the test, the following substances function as activators : IA (indoleacetic), IB, NA, PA (phenylacetic), vitamins B₁ and B₆ and ethylene. A mixture composed of equal parts of two substances proved as effective or more effective than 3- and 4-substance mixtures. In these tests vitamins B₁ and B₆ functioned as activators for root formation in cuttings and not as rootgrowth factors. It is concluded that further data are needed than have hitherto been published before B₁ can be recommended for general practical use as a soil amendment. [From authors' summary.]

798. SWARTLEY, J., AND CHADWICK, L. C. 577.15.04

Synthetic growth substances as aids to root production on evergreen and softwood deciduous cuttings.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1099-1104, bibl. 4.

These experiments by the Horticulture Division of the Ohio State University are summarized as follows :—Growth substances incorporated with talc are nearly as effective as the solution method. At the same time they possess definite advantages such as greater ease of application and wider latitude of effective and safe use. The value of applying growth substances to both narrowleaf evergreens and softwood deciduous cuttings has been further demonstrated. Another possible advantage of treating softwood cuttings is the apparent ability of the treated cuttings to tolerate a wider range of conditions. Although growth substances in the free acid form are in general more effective than the amides, particularly with the more difficult plants, amides show promise in extending the present range of practical application of these same substances. In experiments with *Bouvardia Humboldtii* and *Abelia grandiflora* the fineness of talc and method of mixing made little difference. Moistening of the base of the cutting before dipping in powder is important. Dipping in alcohol instead of water has not proved beneficial. Synthetic growth substances in general produce longer roots in addition to more roots.

799. MEAHL, R. P. 577.15.04

Effect of pretreating evergreen cuttings with alcohol before using root-promoting substances in powder form.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1105-8, bibl. 4.

Trials at State College, Pennsylvania, indicate that with most species tried dipping in water or alcohol prior to insertion in root-promoting dusts is advantageous. Alcohol appears not to be significantly better than water.

800. MITCHELL, J. W., AND STEWART, W. S. 577.15.04

Comparison of growth responses induced in plants by naphthalene acetamide and naphthalene acetic acid.

Bot. Gaz., 1939, 101 : 410-27, bibl. 9.

The responses to naphthalene acetamide and to naphthaleneacetic acid are described and, where similar, are slower in the case of acetamide than of acid. Some responses common to

both were negative curvatures in stems of etiolated pea, bean and *Avena* coleoptiles and delayed tumour and root formation on bean. Dissimilar responses associated with acetamide were lignification of bean stems associated with increased cambial activity, more fibrous root growth of beans, and leaf curling following the lateral treatment of stems of petunia.

801. MITCHELL, J. W. 577.15.04 : 635.65
Effect of naphthalene acetic acid and naphthalene acetamide on nitrogenous and carbohydrate constituents of bean plants.
Bot. Gaz., 1940, 101 : 688-99, bibl. 7.

Application of alpha-naphthaleneacetic acetamide and alpha-naphthaleneacetic acid to the stems of bean seedlings affected the total amount and distribution of carbohydrate and nitrogenous compounds in various portions of the plant and also in the plant as a whole. The chemical responses varied with the treatment and in general were closely associated with growth responses. [From author's summary.]

802. GRACE, N. H. 577.15.04
Vegetative propagation of conifers.* IV. Effects of cane sugar, ethyl mercuric phosphate and indolylacetic acid in talc dust, on the rooting of Norway spruce.
Canad. J. Res., 1940, 18, Sec. C, pp. 13-17, bibl. 4.

Indolylacetic acid at 1000 p.p.m. had increased rooting of Norway spruce cuttings by about 10% three months after planting, but at 5000 p.p.m. rooting was reduced significantly. Naphthylacetic acid reduced rooting at both concentrations. Indolylacetic acid alone increased root length per rooted cutting but when in combination with sugar increase in root length was inhibited. Organic mercury alone or in combination with indolylacetic acid reduced root length but sugar and mercury in combination exerted no greater inhibition than either alone.

803. GRACE, N. H., AND THISTLE, M. W. 577.15.04
Vegetative propagation of conifers.* V. The effect of indolylacetic acid and nutrient solutions on the rooting of Norway spruce cuttings.
Canad. J. Res., 1940, 18, Sec. C, pp. 122-8, bibl. 7.

The effects of treating Norway spruce cuttings with a series of solutions containing 1/729-400 p.p.m. indolylacetic acid were reduced rooting and increased mortality. The adverse effects were still further increased by the addition of nutrient salts to the treating solutions. These negative results of solution treatment contrast with beneficial effects from application of indolylacetic acid in talc dust.

804. SKOOG, F. 577.15.04
Experiments on bud inhibition with indole-3-acetic-acid.
Amer. J. Bot., 1939, 26 : 702-7, bibl. 14.

Experiments with peas show that indole-3-acetic acid can inhibit growth directly in buds.

805. BARTON, L. V. 577.15.04 : 631.531.17
Some effects of treatment of non-dormant seeds with certain growth substances.
Contr. Boyce Thompson Inst., 1940, 11 : 181-205, bibl. 23.

The author reports the results of experiments in which many different kinds of promptly germinating seeds were treated with various growth stimulants in vapour, liquid and dust form and the results noted. Neither the speed nor percentage of germination was increased by soaking in six different concentrations of potassium α -naphthaleneacetate or by treatment with indolebutyric acid at four strengths in powder form. Tomato plants grown to maturity from treated seed showed no stimulation but rather persistent stunting effects. The flowering in a number of common garden flower plants was not affected by seed treatment. The tap roots of radishes grown from treated seed tended to be abnormal, giving the appearance of a double root.

* Parts I, II, III, *Ibidem* 17, Sec. C, pp. 178-80, 312-16, 376-9; *H.A.* 10 : 10, 11, 12.

806. YAUDEN, W. J. 577.15.04 : 631.531.17

Seed treatments with talc and root-inducing substances.

Contr. Boyce Thompson Inst., 1940, 11 : 207-18, bibl. 7.

The treatment of wheat and soybean seed in the dry state with indoleacetic acid, naphthalene-acetic acid and indolebutyric acid, all in talc, and with talc alone and with Rootone at different concentrations did not result in better germination or increased growth. On the contrary the controls grew slightly better, which indicates that the effect of the talc was slightly deleterious. The plants were grown in sand and soil in the greenhouse and in the field.

807. BARTON, L. V. 577.15.04 : 631.531.17

Some effects of treatment of seeds with growth substances on dormancy.

Contr. Boyce Thompson Inst., 1940, 11 : 229-40.

Treatment of dry, dormant seeds of the domestic apple (*Pyrus* sp.) and *Pyrus Malus* var. *Niedzwetzkyana*, with growth substances in concentrations of 3.7 to 320.0 mg/l. had no effect on their subsequent production of seedlings. On the other hand, seeds of *Ulmus americana*, which did not require a pretreatment period at low temperature for germination but which showed improved germination capacity with such treatment, seemed to benefit by the application of solutions of 35.5, 11.8, or 3.7 mg./l. of potassium α -naphthaleneacetate. This benefit was relatively small, however, so that growth substance treatment of these seeds could not be used as a substitute for either low-temperature pretreatment or soaking in water under a light source as a means of speeding up the germination. The germination of seeds of *Cornus florida*, *Cornus stolonifera*, *Pyrus* sp., and *Pyrus Malus* var. *Niedzwetzkyana*, which had been after-ripened by a period at 5° C., was inhibited by treatment with growth substances. This inhibiting effect was partially removed by a second period at 5° C., but abnormalities often appeared in the seedlings so produced. Growth substance treatment of germinated seeds of *Lilium auratum*, *Paeonia suffruticosa*, and *Viburnum* sp. failed to initiate growth of the dormant epicotyls. [Author's summary.]

808. CROXALL, H. E., AND OGILVIE, L. 577.15.04 : 631.531.17

A note on the incorporation of growth promoting substances in seed dressings.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 100-2, bibl. 1.

This article is, in effect, a summary of successful experiments carried out at Long Ashton and described in detail in *J. Pomol.*, 1940, 17 : 362-84; *H.A.*, 10 : 19.

809. McILVAINE, H. R. C., AND POPP, H. W. 612.014.44 : 577.15.04

Further studies on growth substances in relation to the mechanism of the action of radiation on plants.

J. agric. Res., 1940, 60 : 207-15, bibl. 15.

The results reached on turnip seedlings substantiate previous conclusions of the authors that the formative effect of radiation may be at least partly explained on the basis of the effect of radiation on growth substances in the plant. [From authors' summary.]

810. KHOLODNY, N. G., AND GORBOVSKY, A. G. 577.15.04 : 581.132

The effect of heteroauxin on photosynthesis. [Ukrainian, Russian and English summaries.]

J. Inst. bot. Kiev., 1939, Nos. 21-22 (29-30), pp. 369-75, bibl. 4.

Ukrainian experiments on the leaves of lilac, poplar, jasmine, hemp, hydrangea and other plants led to the conclusion that very low concentrations of indole-3-acetic acid cause a temporary intensification of photosynthetic activity on direct introduction into the assimilating tissue of green leaves.

811. TAJIMA, Y. 577.15.04 : 581.163

Experiments on effects of growth hormones on parthenocarp and rooting of cuttings in horticultural plants. [Japanese.]

J. hort. Ass. Japan, 1939, 10 : 281-300, bibl. 26.

Using heteroauxin on cuttings optimum concentrations were as follows :—*Pyracantha coccinea* (autumn) 0.005% for 48 hours, (spring) 0.005% for 24 hours; *Kerria japonica* 0.01% for

24 hours; *Serissa foetida* 0.001% for 24 hours. Using phenylacetic acid *P. coccinea* (autumn) 0.005% for 24 hours and 0.005% and 0.01% for 48 hours; *K. japonica* 0.01% and 0.02% for 24 hours. The phenylacetic acid proved best for *P. coccinea*, the heteroauxin for *K. japonica*. Rooting was greatly affected by time of setting and the state of nutriment of the cuttings. The two factors of concentration and duration of treatment determine correlatively the optimum treatment. Heteroauxin solution kept till a red precipitate appears is practically useless for rooting. The effects on root formation are seen well above the portions actually immersed in the solution. Human urine was found to promote rooting in tomatoes.

812. SEREISKY, A. S. 577.15.04 : 581.163

The effect of heteroauxin on the ovaries of some plants. [Russian, English summary 32 lines.]

J. Inst. Bot. Kiev, 1939, Nos. 21-22 (29-30), pp. 377-93, bibl. 17.

In 1939 the effect was studied at Kiev of growth stimulants on ovaries of the greater celandine, foxglove, luffa, egg plant and water-melon. The results of experiments, which are described in full, may be summed up as follows:—(1) *Chelidonium majus* L. There was a marked stimulation of growth of carpels of the pod-shaped bolls after the ovaries of castrated flowers had been treated with heteroauxin paste, seedless parthenocarpic pod-shaped bolls reaching the size of normal bolls. 1% paste was more effective than 0.1% paste. Treatment with pure lanolin was appreciably less effective than 1% heteroauxin lanolin paste. (2) *Digitalis purpurea* L. also responded to such treatments but to a slighter degree. (3) *Luffa cylindrica* Roem. Heteroauxin paste caused a more or less marked stimulation of parthenocarpic development of fruits, this largely depending on heteroauxin concentration and on method of treatment. The largest parthenocarpic fruits with long, strong fruit-stalks were obtained by treating mature ovaries with 1% heteroauxin paste. (4) *Cucurbita Pepo* L. Heteroauxin treatment of flowers with the style and stigma removed was more effective than on flowers with ovaries left intact. The condition of fruit clusters at the time of treatment had an important bearing on the subsequent shape, seed production and seed quality of parthenocarpic fruits. (5) *Citrullus edulis* Pang. The treatment consisted of removal of the clusters as far as the ovaries and covering the cut surfaces with 1% heteroauxin paste and pure lanolin. Controls had clusters removed but were given no paste. No signs of parthenocarpic fruit development were observed on controls, the effect of lanolin alone was but slight. 1% heteroauxin paste at first stimulated the growth of ovaries and fruit stalks but subsequently caused browning and death of the ovaries. Apparently the concentration was too strong for water-melon. Immature clusters suffered in this regard less than clusters treated at a mature stage.

813. SNOW, R. 577.15.04

A hormone for correlation inhibition.

New Phytol., 1940, 39 : 177-84, bibl. 26.

Continuing previous experiments the author here shows that in pea plants correlative inhibition from a growing shoot apex can travel down one shoot and up another decapitated shoot and can then enter a decapitated shoot of another plant, crossing a protoplasmic discontinuity where the tissues are only in moist contact. Since previous experiments have shown that the inhibiting influence which travels up a lateral shoot is not ordinary auxin, it is concluded that the inhibiting influence is another hormone. Went's "diversion" theory of inhibition is not thought to explain this experiment. Other evidence that the inhibition of lateral buds is not directly due to auxin is provided by an experiment showing that in peas they are negatively geotropic even when partially inhibited. [From author's summary.]

814. VAN OVERBEEK, J. 577.15.04

Evidence for auxin production in isolated roots growing in vitro.

Bot. Gaz., 1939, 101 : 450-6, bibl. 12.

Isolated pea roots were cultivated *in vitro* under sterile conditions in such a way that each week the culture was continued with the 10 mm. tip only and the basal parts were discarded. The total amount of auxin extracted from these discarded bases during twenty weeks was nine times as much as that extracted from the initial tip from which the cultures originated.

815. AVERY, G. S. 577.15.04

Alcohol extraction of growth hormone from plant tissue.

Amer. J. Bot., 1939, 26 : 679-82, bibl. 14.

A method is described for the rapid extraction of all alcohol-soluble growth hormone from ground plant tissues, using absolute ethanol. It does not involve the use of ether or chloroform and extracts can be prepared quickly for testing by standard procedures. [From author's summary.]

816. ROBBINS, W. J. 577.15.04

Growth substances in agar.

Amer. J. Bot., 1939, 26 : 772-8, bibl. 15.

Experiments with *Phycomyces Blakesleeanus* on agar show that the possibility of the occurrence of growth substances in this medium must be considered.

817. EATON, F. M. 577.15.04 : 546.27

Interrelations in the effects of boron and indoleacetic acid on plant growth.

Bot. Gaz., 1940, 101 : 700-5, bibl. 4.

Experiments with young cotton plants show that indoleacetic acid will to some extent replace boron as an element essential to the growth of root, stem, leaf vein, and other leaf blade tissues. The results suggest that boron is essential to the formation of auxin in plants. [Author's summary.]

818. STEWART, W. S., AND WENT, F. W. 577.15.04

Light stability of auxin in *Avena* coleoptiles.

Bot. Gaz., 1940, 101 : 706-13, bibl. 17.

Auxin, once it has been extracted from plant tissues, is stable in light. As shown by ether extractions, 19% of the auxin inside the plant is inactivated by sunlight or incandescent electric light (23.5% inactivated, omitting negative cases). There is no corresponding decrease in the case of free-moving auxin. [Authors' summary.]

819. BUTTERFIELD, N. W., AND McCLINTOCK, J. A. 577.15.04

New method of treating cuttings.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1077-9.

The authors describe a method in which cuttings were submitted to treatment with growth substances under vacuum. The result was to increase the weight of the cuttings and better distribute the growth-promoting substance at the basal ends. The subsequent growth of plants was not inhibited [but rooting was apparently not helped in plants such as apple, pear, and plum, which are normally hard to root from cuttings.—ED.].

820. BONNER, J., AND GREENE, J. 577.15.04 : 577.16

Further experiments on the relation of vitamin B₁ to the growth of green plants.

Bot. Gaz., 1939, 101 : 491-500, bibl. 8.

Vitamin B₁ promotes vegetative growth in many species of green plants but does not promote flowering or have any effect on the number or quality of fruits or flowers other than can be attributed to increased vegetative vigour. On the other hand it is not detrimental to production. The response of different species of green plants to additions of vitamin B₁ depends on the amount of this growth factor which each species is able to synthesize under the prevailing environmental conditions. Tomato, which does not with added growth respond to vitamin B₁, was found to contain at least three times as much vitamin B₁ in its leaves as was found in the leaves of other plants which do respond. Other plants which do not respond to vitamin B₁ also had a larger vitamin B₁ content in their leaves. When vitamin B₁ is supplied to the roots of plants grown in sand culture the vitamin content of the leaves is increased over that of unsupplied control plants.

821. THIMANN, K. V., AND SCHNEIDER, C. L. 577.15.04

Differential growth in plant tissues. II. A modified auxin test of high sensitivity.

Amer. J. Bot., 1939, 26 : 792-7, bibl. 10.

- LINK, G. K. K., AND EGGERS, V. 577.15.04
***Avena* coleoptile assay of ether extracts of nodules and roots of bean, soybean and pea.**
Bot. Gaz., 1940, 101 : 650-7, bibl. 12, being *Contr. Hull bot. Lab.* 511.
 WONG, C. Y. 581.163
Progress report on induced parthenocarp in some horticultural crops.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 158-60, bibl. 5.
 Use of growth substances.

Soil and nutrition.

822. SALTER, R. M. 631.4 : 581.14
Some soil factors affecting tree growth.
Science, 1940, 91 : 391-8, bibl. 31.

The author describes the findings of soil investigators in different spheres of soil work especially those concerned with its relations to tree growth. He summarizes as follows :—It becomes increasingly evident that continued root growth with the establishment of new root-soil contacts is necessary for the normal entrance of both water and mineral nutrients into the root. This concept emphasizes the ecological importance of factors tending either to impede or favor the spread and permeation of roots in the soil. The characteristics of soils with respect to (1) available water capacity, (2) permeability to water and (3) permeability to air are largely determined by the volume and size distribution of the soil pore space. The latter is conveniently characterized by measuring the water held by a soil at varying moisture tensions. In recognition of the foregoing, it may be concluded that a better understanding of root-soil relationships should result from more general application of interpretative studies of soil pore space conditions to root development, and from the development and application of micro-methods for studying the conditions, both physical and chemical, existing at the actual root soil interface.

823. WHITE-STEVENS, R. H., AND JACOB, W. C. 631.432
The rapid detection of soil moisture.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 261-6.

A description of the technique used in the Delmhorst carbide-moisture detector method together with a comparison of results with those got by the official A.O.A.C. method, as also a description of the technique used in the conductivity method based on a report by Bouyoucos and Mick.

824. KARSTEN, K. S. 581.144.2 : 631.433
Root activity and the oxygen requirement in relation to soil fertility.
Amer. J. Bot., 1939, 26 : 855-60, bibl. 15.

The dropping mercury kathode may be conveniently used for the quantitative determination of oxygen in soils. A reduced oxygen content and reduced rate of plant growth resulted from treatments of soil with starch and ammonium sulfate. [Author's summary.] The work was carried out at Madison, Wisconsin.

825. JOHNSTON, J. C. 631.415
What does pH mean to the grower?
Calif. Citrogr., 1940, 25 : 228-9.

The meaning of pH is explained in simple terms to growers in a discussion at the Citrus Institute, San Bernardino, California. pH is a mathematical symbol designating a scale of values used to measure degrees of acidity or alkalinity. The degree of acidity or alkalinity determines to a large extent the chemical behaviour of substances dissolved in water. The degree of acidity or alkalinity as explained by chemists is determined by the concentration of hydrogen ions or more accurately the balance between hydrogen (acid) and hydroxyl (alkaline) ions. The pH scale has 14 points with 7 indicating neutrality. Points below 7 indicate degree of (not total) acidity, points above indicate degree of alkalinity. The application of pH measurements to solutions which are uniform throughout and relatively stable is simple but to the complex and ever-changing soil it is less so, and soil scientists do not agree

as to the meaning or value of pH measurements as applied to soil. Among the factors which determine the pH value of the soil are (1) the nature of the soil solution, (2) character and distribution of minerals, (3) nature and amount of colloidal material, (4) activity of plants and other organisms, (5) temperature, (6) amount of soil moisture, often the most important factor. These factors are variable and consequently the pH of a soil is variable though usually only within reasonable limits—1 point of variation would be considered extreme. The degree of acidity or alkalinity determines the solubility of many plant food elements, other important considerations being (1) amount and condition of minerals, (2) buffer capacity (or resistance) of the soil to change in acidity or alkalinity. Thus in a soil having a high alkalinity certain minerals may tend to be unavailable either through short supply or unfavourable size of particles but if the mineral is abundant the plant may obtain sufficient in spite of the handicap of alkalinity. Some minerals are more available than others under unfavourable conditions, thus magnetite will furnish iron to plants under more alkaline conditions than other forms of iron. While plants have a certain ability to change the reaction of the soil in the immediate contact with their roots, some soils, e.g. limestone, contain substances called buffers which resist such changes. The difference between a weakly buffered and a highly buffered alkaline soil of the same pH may be that the former will grow normal plants while the latter will not grow plants at all owing to its resistance to the plant's attempts to lower the pH enough to permit growth. The suitability of the soil for growing plants is determined by the following factors: (1) fertility, (2) salinity, (3) pH, (4) texture, (5) structure, (6) buffer capacity, (7) aeration, (8) drainage, (9) soil flora, etc.

826. BROADBENT, H. R.

631.459 + 631.874

Erosion and humus.

Gdnrs' Chron., 1940, 107: 152-3, 164-5, 180-1.

The prevalence and effects of erosion are described. The principal ill effect is that the soil is deprived of humus without which plant life cannot thrive. The Indore process for the production of humus adapted for use on a small scale is described. The author claims that this method, which admittedly requires some hard work, produces the best compost in the shortest time.

827. MEIJERS, P. G.

631.874

Eenige beschouwingen over het vraagstuk der groenbemesting. (**On the question of green-manuring.**)

Korte Meded. RijkslandProefst. Groningen 83, 1939, pp. 16, reprinted from *Gron. Landbouwblad*, January 21 and 28, 1939.

The advantages and disadvantages of green manuring are discussed and examples given with special reference to Holland. There are many factors involved so that green manuring is by no means an exact science, in fact it is not easy in any given case to foretell what the results will be. A few notes are given of experimental work at Groningen but most of the effects in Holland discussed, whether good or bad, are derived mainly from observations. Although reference is made to scientific work in America and elsewhere on the subject there is no bibliography.

828. BERKNER, F., WIESE, E., AND NEWRZELLA, B.

631.874

Gründungsversuch.* (**Green manuring trials.**)

Bodenk. u. Pflanzenernährung, 1939, 13: 370-84, bibl. 4.

Berkner notes that in early experiments with the leguminosæ including clover, lupins and crimson clover amassed the greatest store of nitrogen and consequently had the best effects on field crops grown afterwards. It was moreover found that plants not belonging to the leguminosæ must be considered unsuitable for green manuring. In the present articles further experiments confirming the above were made with the following green manuring plants:—Yellow sweet lupins, field peas, crimson clover, crimson clover and rye grass, maize, Sudan grass, sunflower, rape, field peas and Sudan grass, yellow sweet lupins and Sudan grass, crimson clover and maize, crimson clover and rape, turnips. Fallowing after rye resulted in decreased yield the following year, explicable by loss of nitrogen. The highest crop of potatoes was taken off the plot on which there had been crimson clover which was fed off *in situ*, the increased crop

* For an account of the reciprocal influence of fruit and green manure crops, see Schulz, F., in reprint from *Landw. Jb.*, 1936, Vol. 82, No. 5, pp. 80.

being attributed to strong growth of roots, which contained considerable N reserves. A KP dressing had no effect on the green crop but increased the yield of the potatoes. Ploughing in of non-leguminosae is not to be recommended and results only in decreased yield in the crops which follow. Ploughing in of green manure crops as compared with feeding them off is always done at a loss and should therefore never be done with plants which stock will eat.

829. SCHEFFER, F., AND HAUSMANN, W. 631.85 : 631.411.4
Über den Einfluss der Humusstoffe auf die Löslichkeit der Phosphorsäure
verschiedener Phosphorsäureverbindungen. (**Humus substances as affecting
the amounts of available phosphorus.**)
Phosphorsäure, 1939, 8 : 30-9, bibl. 8.

In German experiments farmyard manure, peat, brown coal dust and cellulose increased the availability of phosphoric acid of crude phosphates (apatite, constantine and phosphorite) and so considerably increased their value as fertilizers. Permanent humus (Dauerhumus) was as beneficial in this respect as nutritive humus (Nährhumus). The effect of the latter is explained by a continuous and slow development of CO₂ which frees the phosphoric acid from its compounds and maintains it in this condition. The action of the permanent humus is ascribed to the humus acids forming inorganic, complex compounds with the phosphoric acid. These become available to plants through microbic action in the soil.

830. ALLISON, F. E., LUDWIG, C. A., HOOVER, S. R., AND MINOR, F. W. 631.847
**Biochemical nitrogen fixation studies. I. Evidence for limited oxygen supply
within the nodule.**
Bot. Gaz., 1940, 101 : 513-33, bibl. 2.
II. Comparative respiration of nodules and roots including non-legume roots.
Ibidem, 101 : 534-49, bibl. 6.

I. Evidence is presented concerning oxygen supply within the nodules of leguminous plants. The general experimental methods and special techniques employed are described. The results obtained with detached nodules indicate that with most nodules maintained in air or with large nodules at oxygen concentrations up to 100% the interior of the nodules is under anaerobic or partially anaerobic conditions. Under natural conditions in the soil the oxygen supply within the nodule is also limited.

II. The results obtained indicate that the nodule consists of plant cells largely filled with comparatively inactive bacteria. The bacteria oxidize only a very small portion of the total carbohydrate photosynthesized by the host plant.

831. RAYNER, M. C. 582.8 : 581.144.2 : 633.51
The mycorrhizal habit in crop plants, with a reference to cotton.
Emp. Cott. Gr. Rev., 1939, 16 : 171-9, bibl. 16.

The author outlines the present rather vague state of knowledge of the relation between mycorrhiza and the nutrition of their host plants. The theories of Frank, that the fungi obtain and give to their host carbon and nitrogen from the soil humus, and of Stahl, that they obtain mineral salts, are considered not to be exclusive. The very wide occurrence of the mycorrhizal habit in crop plants suggests that this relationship is of an importance deserving greater study, but "it is not hereby suggested that in all cases of regular mycorrhizal association the habit is obligate or that some degree of mycotrophy is necessary for complete nutrition". Nevertheless, the author thinks that further work will support Sir A. Howard's main conclusions on soil fertility.
W.S.R.

832. McCOMB, A. L. 582.8 : 581.144.2
**The relation between mycorrhizae and the development and nutrient absorption
of fine seedlings on a prairie nursery.**
J. For., 1938, 36 : 1148-54, bibl. 9.

Samples of mycorrhizal and non-mycorrhizal pine seedlings were taken and analysed for N, P and K. The mycorrhizal seedlings contained more than twice as much dry matter as the non-mycorrhizal. The percentage of N and K was similar in both, but the percentage of P in the non-mycorrhizal plants was only about half that in the mycorrhizal ones. It is concluded

that differences in plant development were due to differences in availability of phosphorus, and that the mycorrhizae had been the agency which enabled the affected seedlings to absorb this element sufficiently rapidly. W.S.R.

833. FRIEND, W. H. 632.19 : 631.8

The crow-bar method of applying soil correctives, plant nutrients and disease inhibiting chemicals about the roots of horticultural plants.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1080-3, bibl. 5.

The crow-bar method consists of boring relatively small holes into the soil about growing plants. Into these holes the corrective chemicals are inserted. It appears to be economical of materials and to be practicable and lasting in its effects. The method here described is being successfully used for treating chlorotic citrus trees in California.

834. ILJIN, W. S. 581.192 : 546.41

Calcium content in different plants and its influence on production of organic acids.

Bull. Ass. russe. Rech. sci. Prague, Vol. 7 (12) (Section des sciences naturelles et mathématiques 41), 1938, pp. 43-76.

The results of the studies at the Laboratory of Plant Physiology of the Charles' University in Prague and the Lednice Biological Station in Moravia may be summed up very briefly as follows:—Calcium content in plants of many different species was found to depend on the amounts of calcium in the soil. Conditions of climate, insolation and humidity were only secondary factors. Concentration values of dissolved calcium in plant sap were likewise largely determined by the amount of it in the soil. Some species were found to be incapable of regulating calcium intake and contained as much calcium in the sap as they absorbed from the soil. Notes appear on the production in plant sap of oxalic acid, tartaric acid, citric acid, malic acid, total organic acids and organic compounds of nitrogen, as influenced by the calcium amounts dissolved in the sap.

835. BORON AGRICULTURAL BUREAU. 546.27 : 63

Boron in agriculture.*

Boron agricultural Bureau, Abford House, Wilton Road, London, S.W.1, 1940, pp. 36, bibl. 112.

This is a condensed and well illustrated review of boron deficiency work. The following crops are considered: sugar beet, mangolds, red table beet, swedes, turnips, kohlrabi, potatoes, cereals, flax, legumes, apples, pears, plums, cherries, apricots, cabbage, cauliflower, lettuce, kale, collard, broccoli, celery, tomatoes, flowering bulbs and trees, citrus, coffee, cotton, and tobacco. Growers having related problems are advised to consult their local agricultural advisory centres.

836. ANON. 546.27 : 633/634

Boron in agricultural and horticultural practice.

Nature, 1940, 145 : 766-7.

A note of publications and work on boron in agriculture. Work noted concerns pineapples, swedes and turnips, apples, coffee, potatoes, tobacco, sugar beet, and deficient soils.

837. EATON, F. M., AND WILCOX, L. V. 546.27 : 631.4

The behaviour of boron in soils.

Tech. Bull. U.S. Dep. Agric. 696, 1939, pp. 57, bibl. 39.

A study in San Fernando Valley, California, mainly of problems relating to fixation of boron by soils and of boron remaining in soil solutions. One chapter deals with the accumulation of boron in lemon leaves, and another with the availability of boron to tomato and cotton plants in tourmaline-quartz soils. Results are discussed. On irrigated lands the use of sulphur or lime to change boron relationships cannot be encouraged except perhaps under exceptional conditions. Biological analyses, using as a test plant the particular plant in question, are regarded as the best means of determining boron deficiency in soils.

* See also 817, 955, 956, 1047, 1080.

838. COX, T. R.

546.27 : 633.63-2.19

Relation of boron to heart rot in the sugar beet.*J. Amer. Soc. Agron.*, 1940, **32** : 354-70, bibl. 38.

After giving an account of previous work on the subject in different parts of the world the author describes studies on sugar beet seedlings in sand cultures, on field-grown beet showing marked boron deficiency symptoms, and on experiments made to afford information on the solubility of borax after application to the soil.

839. THOMAS, W., AND MACK, W. B.

631.8 : 581.144.4 : 581.192

Salient features of the method of foliar diagnosis.*Proc. Amer. Soc. hort. Sci. for 1939*, 1940, **37** : 253-60, bibl. 20.

The graphic representation of the three-component system, nitrogen, phosphoric acid, and potash, which plays a major role in the physiology of plant nutrition, is described in detail. The relationship of the optimum in the pure science of physiology to the optimum in practical agriculture is discussed in terms of the experimental facts established by the method. The foliar diagnosis values of the known optimum serve as a base of reference for all other modes of nutrition obtained for a particular species. The reciprocal effects, or the action of one element on another, are discussed in relation to their influence on the "nutrient balance" through displacement of the intensity of nutrition and the $N-P_2O_5-K_2O$ equilibrium. Conclusions of practical importance are drawn from the facts. The method of foliar diagnosis applied to a particular species in a particular soil in a given year is an incontestable means of control by indicating the direction in which nutritional modifications are required. [Authors' summary.]

840. GORDON, W. E.

578.67 : 581.144.4

A labour-saving technique for leaf samples in histological work.*Science*, 1940, **91** : 390.

When studying plant leaves extensive sampling for histological purposes is often essential. The samples may come from various parts of the same leaf or from similar parts of different leaves. Accordingly recording of the source of each sample is necessary. This is made easier by adopting the following procedure :—Duplicate numbers in Indian ink are put on the fresh leaves in the region from which the sample is to be taken. A disc-shaped piece of leaf including one of the duplicate numbers is punched out to furnish the sample and the other number is left to record the source. A crow-quill pen is found very suitable. With a clean pen of this type no difficulty is found in numbering the leaves provided their surface is free from water. Care must be taken that no pressure is applied by the pen and that the numbers are dry before the samples are put in the fixing fluid. The ink numbers are not dissolved or faded by chrom-acetic or by formalin-acetic-alcohol fixations or by any grade of alcohol in the ethyl or butyl alcohol series. They equally well withstand treatment with such cleaning agents as dioxan and chloral hydrate.

841. MER, C. L.

581.11 : 581.144.4

The factors determining the resistance to the movement of water in the leaf.*Ann. Bot., Lond.*, 1940, **4** : 397-401.

Experiments were made with leaves of *Pelargonium zonale* var. Paul Crampel. The effect of severing the midrib and parts of the lamina on absorption and transpiration is described and the conclusion is drawn that the resistance to the movement of water through the net veins of the leaf is very small compared with the resistance to the passage of water out of the veins into the mesophyll cells.

842. BUSLOVA, E.

581.174.1

New data on protochlorophyll. [Russian, English summary 1 page.]*Publ. (Zhurnal) Prats) Ukrain. Acad. Sci. Kiev*, 1938, pp. 27-42, bibl. 32.

Accounts of Russian experiments with over 60 plants belonging to *Cruciferae*, *Compositae*, *Papilionaceae*, *Cucurbitaceae*, *Solanaceae*, *Chenopodiaceae*, *Caryophyllaceae*, *Papaveraceae*, *Labiatae*, *Oleaceae*, *Polygonaceae*, *Scrophulariaceae*, *Linaceae*, *Ranunculaceae*, *Gramineae* and *Liliaceae*. It is shown that at least three different protochlorophylls are produced in the etiolated shoots, differing more or less from chlorophyll. In most plants only one protochlorophyll could be found, namely that discovered by Monteverde.

General.

843. NAYLOR, A. W., AND GERNER, G. 612.014.44
Fluorescent lamps as a source of light for growing plants.
Bot. Gaz., 1940, 101 : 715-6.

The success is recorded of 30-watt fluorescent Mazda lamps of both white and daylight types as a source of light for growing plants. Plants grown under such lamps, arranged to give an intensity of 600 foot candles at the leaf surface for 16 hours each day, were superior in rapidity of growth and sturdy development to the controls grown with ordinary winter daylight and to others grown with ordinary winter daylight supplemented at 4.30 p.m. by 9½ hours of approximately 60 foot candles of light from an incandescent filament lamp. The lamps give off little heat and so can be placed close to the plants, they are more economical and efficient than incandescent filament lamps and they can be grouped to give any desired quality or intensity of light.

844. MURNEEK, A. E. 581.16
Physiological factors in reproduction of plants.
Growth, 1939, 3 : 295-315, bibl. 73.

The present knowledge of the physiology of reproduction in plants is considered under the following heads:—Theories and experimental evidence on initiation of the reproductive state, nutritional theory of reproduction, hormone theory of reproduction, chief aspects of flower production, fertilization and formation of the zygote, influence of seeds and fruit on the mother plant.

845. MARQUES DE ALMEIDA, C. R. 633.491 : 581.143.5
 Subsídio para o estudo da diferenciação da felogene cicatricial. (**A contribution to the study of differentiation of wound phellogen.**) [English summary 4 pp.]
Agron. lusitana, 1939, 1 : 109-66, bibl. 41.

An attempt is here made to determine the origin of the stimulus which induces differentiation of wound phellogen. The literature is reviewed and different theories are considered. The author's investigations were made on potato tubers. As regards pH values acidification of the wounded tissues was found to take place more slowly in the absence of air, though the final pH figures were not affected. Between the layer about to be suberized, which is always acid, and the parenchyma there were no pH gradients. Oxygen was found necessary for the suberization process both in wounded tissues and in the parenchyma formed by the regenerating layer. The meristematic activity of the regenerating layer is considerably reduced in the absence of oxygen. It was found impossible to identify the scar-promoting substance by its effects with any of the auxins already known. In some cases the wounded areas were treated with lanolin containing β -indolylacetic acid and the effect was noted. The treatment stimulated meristematic activity in the parenchyma over a wide area, but this activity was of little use in protecting the exposed tissues. It hindered the differentiation of wound phellogen. Using the alcohol extraction method it was found possible to isolate from the external region of the wounded tissues a growth-promoting hormone (negative bending) distinct from that which promotes the traumatropisms. Treatment with it of the exposed surface of the tubers resulted in normal suberization of the wounded surface, which indicates that the presence of the hormone counteracted the need for oxygen. The treatment also stimulated differentiation of wound phellogen so far as to regenerate the destroyed protective tissues. Since it was shown that free oxygen does not take an active part in the healing process, although responsible for the activation of the hormone, it is suggested that it may influence some other factor itself capable of mobilizing such a hormone. Possibly the darkening of the wound tissues in contact with air may be due to oxidization of the aromatic compounds brought about by the oxygenase, the activity of which would set free the hormone. It is hoped to test this theory experimentally in the near future.

846. GRAINGER, J. 581.145.1
Studies upon the time of flowering of plants. Anatomical, floristic and phenological aspects of the problem.
Ann. appl. Biol., 1939, 26 : 684-704, bibl. 31.
 The growing points of over 100 plant varieties of diverse habit were examined between 1937 and 1939 in order to find the exact times of flower initiation. The general conclusion is that flower formation and emergence are part of an innate rhythm which can be affected to a certain limited extent by external conditions at various times. These conditions are discussed.
847. HAMNER, K. C. 612.014.44
Interrelation of light and darkness in photoperiodic-induction.
Bot. Gaz., 1940, 101 : 658-87, bibl. 1, being *Contr. Hull bot. Lab.* 512.
 HUME, E. P. 612.014.44
The response of plants to intermittent supplementary light.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1059-65.
 Chrysanthemums, asters, etc.
- EMERSON, R., AND LEWIS, C. M. 581.132
Factors influencing the efficiency of photosynthesis.
Amer. J. Bot., 1939, 26 : 808-22, bibl. 18.
- GODNEV, T. N., AND KALISHEVICH, S. V. 581.17
The increase in number and size of chloroplasts and the accumulation in them of chlorophyll in growing leaves. [Russian, English summary 38 lines.]
Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 51-66, bibl. 14.
 The plant used was *Syringa vulgaris*.
- KISLOV, V. P. 581.144.036
An improvement in apparatus for measurement of internal leaf temperatures.
 [Russian.]
Proc. Lenin Acad. agric. Sci., Moscow, 1940, No. 4, pp. 41-5, bibl. 14.
- KRAMER, P. J. 581.11
The forces concerned in the intake of water by transpiring plants.
Amer. J. Bot., 1939, 26 : 784-91, bibl. 33.
- HOAGLAND, D. R., AND STEWARD, F. C. 581.13
Metabolism and salt absorption by plants.
Nature, 1939, 143 : 1031, bibl. 5.
- HOAGLAND, D. R., AND STEWARD, F. C. 581.13
Salt absorption of plants.
Ibidem, 1940, 145 : 116.
- STEWARD, F. C., AND HARRISON, J. A. 581.13
The absorption and accumulation of salts by living plant cells. IX. The absorption of rubidium bromide by potato discs.
Ann. Bot. Lond., 1939, 3 : 427-54, bibl. 50.
848. STOUGHTON, R. H., AND MULLARD, S. R. 663.61 : 581.084.1
Soilless cultivation of plants.
Fruitgrower, 1940, 89 : 506, 534, 538.

The commercial method of cultivating market crops in nutrient solution is discussed and descriptions are given of the apparatus in use at the Bakeham Farm Nurseries, Englefield Green, Surrey, and of the smaller experimental installation at Reading and of its management. Considerable success on a small scale was obtained with *Gerbera* which is normally a difficult plant to manage in soil. Tomatoes and lettuce were also successful, the latter being of exceptionally good quality. Carnations are now in their fourth vegetative season without contact with soil and show considerable improvement in quality and quantity over the soil-grown controls. The authors conclude that the results obtainable from tank cultivation are limited by the variable climate, that such culture is only possible under glass, that the system may show some reduction in production cost, but that owing to the capital cost of installation only high value crops can be grown. The results likely to be obtained are only in the direction of improvement in

quality of plant, relative freedom from soil-borne diseases, economy in labour and fertilizers. Greatly increased yields are improbable except in so far as a greater control of the plant's normal growth is obtained.

849. OLEINIK, G. YU. 581.192
Determining small quantities of essential oils in plants. [Ukrainian, Russian and English summaries.]

J. Inst. Bot. Kiev, 1939, Nos. 21-22 (29-30), pp. 437-44, bibl. 11.

An apparatus for determining small quantities of essential oils is recommended, which differs essentially from others in that the distilled water does not pass through the oil stratum. This permits the use of receivers with small diameters and very fine scales (0.001 cubic cm.).

850. MAHALANOBIS, P. C. 581.084.2 : 519
A review of the application of statistical theory to agricultural field experiments in India.

Ind. J. agric. Sci., 1940, 10 : 192-212, bibl. 12.

VAIDYANATHAN, M., AND IYER, S. S. 581.084.2 : 519

A note on the analysis of 3³ and 3⁴ designs (with three-factor interactions confounded in field experiments in agriculture.)

Ind. J. agric. Sci., 1940, 10 : 213-36, bibl. 1.

CRIST, J. W. 519 : 581.084.2

Bi-serial r for horticultural research.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 269-71, bibl. 4.

EMMERT, E. M. 519 : 581.084.2
Partial elimination of experimental error from data by the use of significance tests.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 272-8, bibl. 7.

ANDERSON, J. P. 551.566.3 : 635.1/7

Plants used by the Eskimo of the Northern Bering sea and arctic regions of Alaska.

Amer. J. Bot., 1939, 26 : 714-6.

A list and discussion of some 40 plants.

TREE FRUITS, DECIDUOUS.

General.

851. SOUTH AFRICA, UNION OF. 634.1/8 : 382.6
Fruit production in the Union. Report No. 23. The 1937-38 deciduous fruit export season.

Bull. Dep. Agric. S. Afr. 202 (*Plant Industry Series* 51), 1939, pp. 121.

Annotated figures are given of the export from S. Africa of the following fruits : apples, apricots, grapes, nectarines, peaches, pears, pineapples, plums, and prunes.

852. NATIVIDADE, J. V. 634.13
Cultura das pereiras. (Pear-growing in Portugal.)
Ser. Divulgação Minist. Agric. Lisboa 1, 1937, pp. 67.
 A popular guide to pear-growing in Portugal.

853. WIGHT, W. F. 634.25 + 634.22
Seven new peaches and a new plum for the Western States.
Circ. U.S. Dep. Agric. 552, 1940, pp. 22.

Descriptions of seven new yellow-fleshed peaches introduced into the Western States of U.S.A., viz. Leeton, Maxine, Penryn, Nestor, Stanford, Ellis, Farida, and one plum, Padre, a cross of Wickson with Santa Rosa.

854. WORLOCK, R. F. 634.25 : 664.85.25.036.5
Producción de duraznos de envase. (Growing peaches for canning.)
Rev. B.A.P., 1940, 23 : 268 : 31-7.

The article refers to the Province of Cuyo, Argentina. In peaches for canning something more than the external appearance of the fruit has to be considered. Thus the habit of the variety

Montevideo of dropping its fruits before they are quite ripe is immaterial in drying but fatal in canning peaches. Tuscan Cling has the defect of highly coloured flesh around the stone but it has the good quality of early ripening. The following characters should be sought in the variety it is proposed to plant. It must be a clingstone with a small non-splitting stone, flesh firm, colour a golden amarillo without red at the centre, symmetrical and round in shape, and of medium size, not susceptible to gummosis, one that ripens its fruits evenly and without dropping them before full maturity. Some peaches which more or less conform to these requirements are Royal George, Palora, Sims, Phillips. A number of varieties maturing in succession must be planted to avoid congestion at the factory. The stocks which have proved most successful in the nursery of the author are the seedlings from seed of the wild trees from the mountains of San Luis and Cordoba. These stocks are much more resistant to cold than seedling peach stocks from local trees, they have a stronger rootgrowth and are unaffected by eelworms; on the other hand there is little information on compatibilities or adaptability to local conditions. Though life of a commercial peach tree may be 15-20 years, certain disabilities arise with age. The stone increases in size and a small stone is an essential condition of a canning peach. Gummosis and eelworm shorten the life of the tree and reduce the quality of the fruit. The irrigation system, whereby the water passes from one estate to another, is responsible for the spread of much of this. Clean cultivation is another cause of deterioration. The pruning system also affects longevity. To maintain an estate in high production no plantation should be maintained longer than 10 years and a constant succession of numbers of young bearing trees should be arranged.

855. BAGENAL, N. B.

634.22

Plum growing in the light of recent research.

A.R. East Malling Res. Stat. for 1939, A23, 1940, pp. 79-84.

This is a summary of the talks given by the Staff of the East Malling Research Station on Members' Day, 31 August, 1939. Between them they covered the research of the last 25 years as it affects commercial plum growing. Attempts to grow plums on their own roots have merely stressed the necessity for using rootstocks. The merits of rootstocks already tested are discussed. Framework grafting has been adapted for plums, the cleft method proving more successful than the bark method. Thinning has proved commercially successful. Notes are made on grading for size and quality and on storage. Different varieties react very differently to storage. Silver leaf (*Stereum purpureum*) attacks are discussed and the necessity urged of painting pruning wounds with a suitable paint. The paint used by the research station is made up of 2 lb. white lead paste, 2 teaspoonfuls paste driers, 2 tablespoonfuls raw linseed oil and 2 tablespoonfuls turpentine. A second troublesome disease causing dieback is bacterial canker. The infection and distribution of this disease in the tree are noted. Methods of control that suggest themselves are the use of buds for propagating from healthy trees only, spraying to control stem cankers, spraying to control leaf spots, avoiding pruning or other wounds except during the growing season, preferably May and June, and possibly double working.

856. NATIVIDADE, J. V.

634.985.5

Portugal. The greatest cork producing country in the world.

Junta Nacional da Cortiça, Lisbon, 1939, pp. 13.

This is a popular and very short, but none the less instructive, account of the cork industry of Portugal, from which more than half the world supply is obtained. The area covered by the cultivated cork tree (*Quercus Suber* L.) in Portugal is more than 1,500,000 acres. The author remarks that the expression cork forests should give way to cork orchards since the trees sustain all the care that is usually given to fruit trees. The stripping of the outer bark, the corkwood of commerce, is done in June and July when the new cells are actively forming and the membranes still weak, a circumstance which facilitates the operation. The first stripping is done when the tree is 20-25 years old and produces virgin cork used only for grinding. Ten years later there is a second stripping still with restricted uses. After a further nine years the standard cork (amadia) is cut and thereafter at 9- or 10-year intervals until the tree is too old at 120-150 years. There is an experiment station devoted entirely to cork. An account of the properties of cork for which its texture is responsible are given. One cubic inch of cork contains 690 million cells with walls only 0.0000886 inch thick but composed of five distinct layers of which two are

waterproof. The remainder of the publication gives some details of manufacture showing that every scrap and shaving, including the dust, is utilized in some way, and a note of the innumerable uses to which cork is put. The publication is well illustrated.

857. CHARLEY, V. L. S.

663.3

A calendar for farm cider-makers.

A.R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 103-8.

The stated aim of this calendar is to draw the attention of farmers to certain important duties that must be carried out throughout the year in order to attain a satisfactory standard of quality and production in their ciders.

Breeding.

858. RUDORF, W.

634.1/2-2.111-1.523

Die Züchtung frostresistenter Obstsorten mit besonderer Berücksichtigung der Resistenz gegen Spätfrostschäden. (**Fruit breeding for resistance to frost and particularly to late frost.**)

Forschungsdienst, 1940, 9: 266-76, bibl. 10.

In experiments made at Müncheberg fruit buds in different stages of development were exposed to various low temperatures from -2.29°C . to -10.00°C . for periods of 8, 16 and 24 hours. In plums *Prunus spinosa* with the buds in all stages of development proved the most resistant. Hardiness decreased rapidly as bud and flower developed. Experiments with apples showed that there were significant differences in the degree of hardiness due to the stage of bud development, dormant buds being the hardest. There was no evidence of varietal differentiation in hardiness of the flower. All experiments indicated that the hardiness of the buds was determined by physiological growth processes. The buds in the dormant stage are most resistant. Little is known of the duration of dormancy in different varieties. It is usually succeeded by a latent non-dormant state until temperatures become sufficiently high for the buds to start into growth. The difference between minimum temperatures for the development of fruit buds required by different forms and varieties is considerable. Varieties and soils which need only low temperature for development will flower early. Such fruit trees are particularly susceptible to spring frosts. Hence in breeding for hardiness, which has been carried on at Müncheberg on a large scale, late-flowering apple varieties were used. The character of late flowering appeared to be dominant in six Taffet-Apfel seedlings but non-dominant in the hybrids from the cross Golden Winter Pearmain \times *Malus Zumi*. Since in most of Germany the temperature never falls below -30°C ., breeding with late-flowering local varieties appears to give sufficient promise. Some of them have, moreover, a predominant character of wood hardiness. It is not always essential to back-cross with wildings, and in such crosses the poor size and quality of the fruit is the main disadvantage. A collection is being made at Müncheberg of valuable local varieties for breeding purposes. It is hoped to obtain some hybrid varieties that will combine the characters of late flowering, early ripeness and high quality fruit.

*Propagation.**

859. LINCOLN, F. B., AND AMATT, J.

634.11-1.534.6

Root forming ability of apple layers.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 283-6.

Out of 287 types of apple consisting of wildings, the Malling and German clonal types and commercial varieties, only one failed to form roots when layered and this actually formed roots on the mother wood. The root systems were arbitrarily classified into 6 types as follows:—Type 1. Burr knot. A number of small roots initiate directly above the bud and then initiation continues around the sides and under the bud until a solid mat of roots is formed engulfing the bud. Type 2. Several small roots are formed at each of one or more points of root initiation, but do not spread to form a solid mat around the bud. Type 3. A type showing two roots usually initiating from one point; both roots coarse and usually covered with rootlets. Type 4. Roots usually appearing singly from points of initiation. These roots are usually coarse and

* See also 795-821, 845.

are well covered with rootlets. Type 5. This type was typified by those which initiated roots primarily at the junction between mother and daughter plants. Type 6. Very few or no roots.

860. LONGLEY, L. E. 634.22 : 577.15.04

Growth substance in rooting certain *Prunus* species.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1091-2.

The author used the proprietary growth-promoting substances, Auxilin and Rootone, in his attempts to root three *Prunus* species which are normally difficult to root from cuttings. There was no effect with *P. nana*. *P. triloba* showed marked increase in rooting in green wood cuttings treated with Auxilin but not with Rootone. *P. japonica* cuttings were responsive to both substances.

861. CARDINELL, H. A. 634.11-1.541.7

Relation of cracking of graft coatings to the stand and growth of apple scions.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 291-3.

The author (in Michigan) set 1,800 apple scions, using 12 different sorts of grafting wax and noted the growth in the first season. He deprecates drawing any definite conclusions, but he does suggest that there are indications that other factors are more responsible for scion performance than whether or not the wax coating over cut surfaces eventually cracks, as do all but the softest non-drying forms.

862. GARNER, R. J., AND HAMMOND, D. H. 634.13-1.541.11 : 634.14

Studies in nursery technique. The production of double-worked pear trees.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 84-6, bibl. 5.

Certain pears, e.g. Williams, when worked direct on quince prove incompatible. In the past double-worked trees have cost more to produce owing to the extra year in the nursery and the additional manipulations necessary. In the winter of 1937-8 one row each of East Malling clonal quince A and quince C were planted in the nursery, each row containing over 600 rootstocks. They grew normally in 1938 and were grafted the following year as follows:—(1) Double-worked in March 1939, in one operation, the head to be formed at "knee" height in 1940; (2) worked with an intermediate in March 1939, and reworked at "knee" height in March 1940, the head to be formed from the scion in 1940; (3) worked with an intermediate in March 1939, and reworked a few inches above the first union in March 1940, the head to be formed in 1941; (4) control in which second scion was worked direct on quince in March 1939, the head to be formed at "knee" height in 1940. The treatments were repeated four times per rootstock and per scion variety and arranged so as to eliminate or discount the effects of position. Beurré Hardy and Conference were the intermediates. Williams was the upper scion. Details are given of the actual operation in which whip and tongue grafting was used with raffia for tying and hot red wax for sealing. All trees made good growth during 1939, no combination producing less than 84% saleable trees, i.e. trees of 25 in. and over. No incompatibility was noticed, but in this connexion it may be noted that incompatibility in Williams is often not apparent for several years. Of the 288 trees double-worked in one operation, 281 made saleable maidens by the end of the season.

863. CRONK, J. 634.1/2-1.541.44

Frameworking fruit trees by slit-grafting.

Gdnrs' Chron., 1940, 107 : 191.

Slit grafting is a rapid method of frameworking fruit trees which, it is claimed, will produce fruit more quickly than stub-grafting or other similar methods, besides being extremely simple. A two-inch oblique slit is made in the rind of the limb parallel with its direction, the knife being so held that its point meets the outside of the wood of the limb at a tangent. The scion, previously cut to a wedge-shaped base an inch or so in length, is pushed into the slit so that the cut surface of the scion is in close contact with the wood cylinder on one side and the inner surface of the raised rind on the other. It can be set at the desired angle by raising or lowering the apex. Sealing of cut surfaces with grafting wax is necessary but there is no tying or nailing. The best branches are over 1 inch in diameter and the bark should lift readily, which in England is not until the middle of April.

864. KEARNS, H. G. H.

631.543 : 634.1/2

A method of tree staking—its use for bush trees.*A. R. Long Ashton agric. hort. Res. Sta. 1939, 1940, pp. 31-4.*

The normal stakes used for holding bush trees for their first five years are of wood and liable to fail under severe weather conditions despite frequent attention. An account is here given with clear illustrations, of a new method of staking in which locomotive boiler tubes are used as the stake and a modification of the Healey self-expanding tree band as the connecting link between tree and stake. Directions are given for making the whole apparatus and for erecting it. Given drainage holes at ground level, it is thought that the tubes should form excellent stakes which will not need any further attention after erection. [The initial expense would appear somewhat formidable and presumably in wartime an even better use might be made of old boiler tubing, but when peace comes again they should be well worth trial.—ED.]

Rootstocks.

865. HATTON, R. G.

631.541.11 : 634.1/5

The present status of research in rootstock plants and the use of rootstock plants [in Great Britain].*A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 37-41, bibl. 33.*

This paper, which is very highly compressed, was actually the national report for Great Britain made at the 12th International Horticultural Congress, Berlin, August 1938. The Proceedings of the Congress were not yet available at the outbreak of war. A comparison is made of the growth of apples, pears and plums, and damsons on their own roots and on known rootstocks. Their behaviour appears to differ with each variety. Since the difficulties of raising fruit varieties on their own roots commercially still remain, and the size and cropping of trees can be controlled by rootstocks, the latter are likely to remain in use. Notes are given of the results of rootstock work in England with the following fruits:—apples, pears, plums, peaches, cherries and walnuts, specially good and specially bad stocks being named. Investigations into the source of rootstock influence indicate that while an intermediate stem piece is important the root portion of the rootstock generally has more influence than the stem portion. Incompatibility can be avoided and resistance of trunks to disease and frost injury achieved by the use of intermediates and stem builders. [Is it too much to hope that the same author's summary of all the national reports on this subject will soon be available instead of lying pigeonholed in a Berlin office?—ED.]

866. DAY, L. H., AND TUFTS, W. P.

634.1/2-1.541.11-2.651.3

Further notes on nematode-resistant rootstocks for deciduous fruit trees.*Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 327-9, bibl. 2.*A continuation of work reported *Ibidem*, 31 : 75.

867. (i) YERKES, G. E., AND SUDDS, R. H.

634.11-1.541.11

The effect of the stocks on seven years' growth of four apple varieties.*Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 294-7, bibl. 1.*

(ii) TUKEY, H. B., AND BRASE, K. D.

634.11-1.541.11

Size relationships of trees of five varieties of apples on several clonal rootstocks.*Ibidem*, 37 : 299-304, bibl. 4.

(iii) TUKEY, H. B., AND BRASE, K. D.

634.11-1.541.11

Behavior of Malling apple rootstocks in soils of high, medium and low moisture contents.*Ibidem*, 37 : 305-10, bibl. 1.

(iv) SUDDS, R. H.

634.11-1.541.11

The comparative performance of several standard apple varieties on certain rootstocks, principally the clones, Malling I, II, and XIII.*Ibidem*, 37 : 311-8, bibl. 6.

(v) SUDDS, R. H., AND YERKES, G. E.

634.11-1.541.11

The effect of Malling II and IX rootstocks on six apple varieties.*Ibidem*, 37 : 319-21, bibl. 1.

(i) Stock effect on growth at Kearneysville, West Virginia, has been noted during the first seven years in the case of 4 varieties of apple on a large number of seedling and clonal stocks, the former

being derived from open pollinated seed of American eating varieties and French crab, the latter consisting of Mallings I, XIII and XV, Northern Spy and 5 clones of unknown quality from the U.S. Department of Agriculture. Observations show that York Imperial is the most sensitive to stock influence, and that Gallia Beauty shows more differences in size induced by the stocks than do the other two scion varieties used, viz. Staymared and Starking. A trend towards uniformity in growth was noted from the clonal stocks but so far any advantage in this respect over seedling stock is not statistically significant. It is thought to be partly hidden at present by the factor of soil variation. The effect of growth of each variety induced by particular seedlings is noted.

(ii) A progress report is here given of the comparative sizes of 5 varieties of apple tree, viz. Baldwin, Delicious, Early McIntosh, McIntosh and Northern Spy on 17 clonal rootstocks (Malling I-VII, IX, XII, XIII, XVI and U.S.D.A. 227, 312, 313, 317, 323 and 329) and on French Crab seedlings at the end of their seventh growing season at Ithaca and Geneva. The soil at Geneva is a strong loam of high fertility, that at Ithaca a silty clay loam of good fertility but rather heavier than that at Geneva. The orchard at Geneva was clean cultivated, that at Ithaca strip cultivated. Winters at Ithaca during the 7-year period were more severe and the summer rainfall was less evenly distributed. There was a general tendency within the limits of the 5 varieties used for a given rootstock to produce trees of the same general size relationships irrespective of place. Conditions at Ithaca were more severe and there Malling IX was decidedly unsatisfactory. Malling II with its shallow root system also behaved badly at Ithaca. Malling XVI gave larger trees at Geneva than at Ithaca. On the other hand French Crab seedlings did comparatively better at Ithaca. A great range of size difference was noted at Geneva, suggesting that certain factors were operating at Ithaca to even up or mask to some degree the differences between the different combinations.

(iii) Soil moisture tests were made at Geneva on 9 plants each of Malling I, II, IV, VII, IX, XII, XIII and XVI planted in a greenhouse in individual glazed crocks of 10 litre capacity filled with 9,000 c.cm. of Ontario stony loam soil. The plants were then subjected to high, low and medium soil moisture conditions, on the oven dry basis the percentages of moisture being 23.1, 17.3 and 14.9% respectively. The root development of the clones was closely observed and is here shown and the weight increases of entire plants of the different stocks grown under the different soil moisture conditions. Data obtained to date suggest a tentative grouping of rootstocks as follows:—Generally successful under all soil moisture conditions VII, I and XIII; high moisture tolerant I, XVI and VII; low moisture tolerant VII, I and XIII; intermediate in tolerance of high and low moisture IX and XVI; low moisture intolerant IV, XII and II.

(iv) Observations on apple trees set 1932 in a silt loam to silt clay loam soil at Kearneysville, West Virginia, are summarized by Sudds. Red Rome/I combination has proved variable and unsatisfactory; Stayman I trees have been uniformly semi-standards. Red Rome/XIII at 7 and 8 years old were rather below standard in size; Stayman/XIII was vigorous in good soil but very tardy in bearing. No. II proved dwarfing and appears to need fertile soil. Variability was not always significantly more on seedling roots than on Malling II or U.S.D.A. 200. Environmental variations, especially soil factors, were more potent in determining uniformity than were clonal stocks. Trunk girth alone is not an adequate measure of growth.

(v) With York, Gallia, Staymared and Starking No. IX proved very dwarfing in the Cumberland-Shenandoah valley. It was not so dwarfing with Jonathan. In all cases it was more dwarfing than II. II shows promise in deep fertile soils.

868. UPSHALL, W. H.

631.541.11 : 634.11 + 634.13

Dwarf apple and pear trees.

Reprinted from *Canad. Horticulture*, January and February 1940, pp. 6.

Experiments with dwarfing stocks for apples and pears at the horticultural research station, Vineland, Ont., led to the following conclusions. *Apples*.—Malling IX stocks had a very dwarfing effect on R.I. Greening, Melba, Delicious, McIntosh. In the case of Spy the initial dwarfing effect was less marked. For their size the dwarf trees had a wide spread of branches. Most of the fruit could be picked from the ground. In all varieties the trees on Malling IX came into bearing before standard trees, the greatest differences being in those varieties which are normally late in coming into bearing. Standard McIntosh trees outyielded dwarf trees of the

same variety in the seventh year, Melba in the eighth year and R.I. Greening in the tenth year. In the Delicious and Spy varieties, the dwarf trees were still in the lead at the end of the tenth year. But per tree yields are rather misleading, since dwarf trees can be planted very much closer than standards (227 as compared to 108 trees to the acre). On the basis of per acre yields dwarf Greening, Melba, Spy and Delicious outyielded standards up to 10 years of age. In McIntosh yields were approximately the same at that age. Characteristics of trees on Malling IX are described, weak unions and brittleness of the roots being the most objectionable features of dwarf trees. Notes appear on planting. The normal planting distance (12 ft. \times 12 ft.) for trees on Malling IX was found to be rather close under Vineland conditions. At present apple dwarf trees should only be planted as fillers. The most striking feature of experiments with pears was that on one soil quince stocks had a decidedly dwarfing effect and on another much less so. Furthermore, of all varieties tested on one soil only Clapp's Favourite was hastened in bearing through the use of quince rootstocks, whereas on another soil quince stocks brought about earlier bearing in all varieties. In five out of eight comparisons dwarf pear trees outyielded the standard trees. Angers quince stocks, it appears, did not maintain for very long a lead in pear tree production over standards. However, a lead in per acre yields may be maintained several years beyond the seventh year by planting dwarf trees more closely. Scion rooting and breakage at the union are undesirable characteristics of dwarf pear trees. Some varieties did better on quince rootstocks than others. Preliminary experiments with quince C showed that it is more dwarfing than the Angers quince and gives slightly earlier cropping. Bartlett appeared to be more compatible with quince C.

869. TYDEMAN, H. M. 634.11-1.541.11-2.753
Apple rootstocks immune from woolly aphid. II.* The testing in the nursery of new seedling immunes.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 44-6, bibl. 6.

Apple rootstocks proved highly resistant to attack by woolly aphid have been tested as to their pomological characters. In nursery trials with 566 such stocks considerable differences are indicated in the performance of families of diverse parentage under propagation tests. Results are here tabulated. The parentage has included Northern Spy \times Malling I, II, VIII, XII, XV, Merton 789, 793, Winter Majetin, Transparent de Croncels, R. Zuccamaglio, Ben Davis, and Jonathan; Malling I, II, and XV \times Northern Spy; Bristol OF. 5 \times Northern Spy; Merton 793 \times Northern Spy; Merton 789 \times Merton 793 and reverse cross; R. Zuccamaglio \times Northern Spy. An account is given of various methods for discovering the influence on the scion of these rootstocks.

870. TYDEMAN, H. M. 634.11-1.541.11-2.753
Apple rootstocks immune from woolly aphid. III. The influence of four new seedling immunes on Lane's Prince Albert.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 46-8, bibl. 2.

In the winter of 1935 a set of maiden trees of Lane's Prince Albert apple on four Merton, woolly aphid-immune stocks 778, 779, 793 and 789 (i.e. No. II \times Northern Spy) and on Malling IX, II, XII and Northern Spy were planted out in randomized blocks and allowed to grow naturally at East Malling. There were about 38 trees in each set on the Merton stocks and from 15 to 34 on the others. Observation was kept on length of new wood, trunk growth, number of blossom trusses and number and weight of fruits. In these first five years the trees on the Merton stocks have been very similar in performance and somewhat more vigorous but less precocious than either parent. Their vigour appears to lie between that of trees on II and XII.

871. GRUBB, N. H. 634.23-1.541.11
A résumé of the cherry rootstock investigations.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 41-4, bibl. 5.

Prunus Avium, the sweet cherry, Gean, Gaskin or Mazzard. Up to the present out of some 320 seedlings layered some 14 selections are still, after selection for ease of layering, being propagated while 12 more are still available for trial, the remainder being discarded. Whitebarked Harz mazzards recently received are also still under observation. No incompatibility between any of them and either sweet or acid cherry scions has yet been seen. It is clear that different

* For I, see *Ibidem* for 1934, A18, pp. 115-22; *H.A.*, 5: 233.

sweet cherry rootstocks can influence the scion differently in vigour, habit of growth, fruit bearing and character and probably also in susceptibility to bacterial canker and brown rot blossom wilt. Records are still being taken of combinations showing promise.

P. Cerasus or *Cerasus austera*, the acid cherry. The variation found is much greater than among the sweet cherries or mahalebs. None of them has layered so far so readily as the selected sweet cherries, though a few in good seasons have had 50-70% of their layer shoots fairly well rooted. Of 35 layered only 6 remain in the layer beds; there are 3 more as rootstocks in one of the stock trial plots and of these one is suckering freely. Another 25, apparently seedlings, received from the continent in March 1939, will be layered this year. It is thought that Kentish Red, Wye Morello, one of the seedlings raised at East Malling from wild seed, and perhaps the Stockton Morello might be commercially practicable. More seedlings from the seed of named varieties are to be submitted to layering tests. Tests to date indicate that these acid cherry stocks are dwarfing both for Morellos and for sweet cherry scions. Future work lies in finding out how far the acid stocks available are compatible with sweet cherry varieties.

P. Mahaleb, the St. Lucie cherry. There is considerable variation in habit of growth and fruit character though probably less than in sweet cherry. Of 89 mahalebs layered only 3 are still in the layer beds and 2 more are in the stock trial plots. Growth on mahaleb for various reasons, e.g. incompatibility, disease, size of fruit, etc., has not proved satisfactory at East Malling. The 3 selections mentioned above will be retained for further examination.

Ornamental cherries. All combinations of the Japanese cherry on sweet cherry stock have proved satisfactory so far, i.e. up to their fourth or fifth year, except a variety received as *Prunus serrulata albo-rosea* on one selection which showed delayed incompatibility. A few varieties on mahaleb appeared to be totally incompatible. No further work on stocks for the ornamental cherries is contemplated.

872. BRYANT, L. R.

634.23-1.541.11

Sour cherry rootstocks.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 322-3, bibl. 7.

In the spring of 1935 a planting was made on the Colorado Experiment Station grounds of 96 Montmorency cherry trees on seedling mahaleb and 48 on seedling mazzard rootstocks. The soil was a rather heavy loam containing 6-8% lime. Lucerne had been growing for some years previously. Continuous clean cultivation was practised after planting. Observations made in September 1939 showed that under these conditions the mahaleb stocks were preferable. They gave larger trees, better adaptation to the severe winter conditions and greater resistance to chlorosis on the alkaline soils of this area.

873. WINKLEPLECK, R. L., AND MCCLINTOCK, J. A.

634.25-1.541.11

The relative cold resistance of some species of *Prunus* used as stocks [for peaches].

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 324-6, bibl. 5.

Stem and root cuttings, 6 inches long ranging from $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, of a number of materials normally used as rootstocks for peaches were subjected to a temperature of -15° F. in a refrigerator for different periods prior to removal to moist peat moss for a period of 1-3 weeks, after which they were examined for injury. Florida peach seedlings proved least cold-hardy in these tests. Other species and varieties can be listed in order of increasing cold resistance as follows:—Elberta peach seedlings, southern naturals [i.e. peach roots and tops from the Southern U.S. Mountains], myroblan, *Prunus Davidiana*, marianna, *Prunus americana*. The last two exhibited extreme cold resistance.

*Root growth.**

874. (i) BATJER, L. P., MAGNESS, J. R., AND REGEIMBAL, L. O.

634.11: 581.144.2: 632.111

The effect of root temperature on growth and nitrogen intake of apple trees.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 11-8, bibl. 3.

(ii) BOYNTON, D.

631.433: 634.11: 581.144.2

Soil atmosphere and the production of new rootlets by apple tree root systems.

Ibidem, 37: 19-26, bibl. 6.

* See also 824.

(i) In the first of the experiments here described the roots of young York Imperial apple trees were subjected to a temperature of 42° and 45° F. during the growing seasons of 1938 and 1939 respectively. Terminal bud formation quickly followed such exposure in both cases. Even though a high nitrogen nutrient solution was supplied to these potted trees the foliage showed no increase in N content for about 4 weeks, after which the leaves suddenly became greener and secondary growth followed.

(ii) In the second experiment a study was made of the effect of different percentages of oxygen and carbon dioxide on the production of new rootlets in one-year-old budded McIntosh and Red Delicious apple on seedling stocks planted in 2-gallon glazed porcelain crocks. In these preliminary studies at soil temperatures between 55 and 70° F. there was a very marked decrease in the formation of new rootlets as the level of the soil air was reduced much below 15%, at least when the CO₂ increased in about the same amount. When the O₂ level dropped below 10% and CO₂ increased to between 5 and 10%, apparently so few rootlets were formed that top growth was markedly reduced.

875. VINOGRAD, D. I. 634.21 : 581.144.2

Root growth in apricots during their first year. [Russian, English summary 40 lines.]

Proc. Daghestan agric. Inst. Makhach-Kala, 1939, No. 1, pp. 180-218, bibl. 88.

Observations were made for three years at Makhach-Kala on 50 similar one-year-old apricot seedlings, variety Red Cheek, on *Prunus armeniaca* stocks. Experiments are described in detail and data are tabulated. The results may be summed up as follows:—The growth of the root system of apricots goes on throughout the year. The rate of growth is somewhat higher early in the summer and early in autumn. The first stage of increased root growth coincides with the stage of increased longitudinal growth of shoots and development of the leaf apparatus. At that stage the weight of the root system increases more appreciably than the weight of the above-ground portions of the tree. The second growth stage coincides with the time of cessation of longitudinal shoot growth and with the maximum leaf production. This stage is accompanied by an increase in root girth and in total weight of tree. The weight of the above-ground parts of the trees at that time exceeds the weight of the root system. Practical suggestions are made to apricot growers in Daghestan on planting and subsequent care of trees. These are based on detailed knowledge of the behaviour of underground portions of the plant under Makhach-Kala conditions.

Pollination.

876. OERTEL, E. 638.132

Honey and pollen plants of the United States.

Circ. U.S. Dep. Agric. 554, 1939, pp. 64, bibl. 16.

This circular is composed almost entirely of lists of plants known to be important to bees in the different States, of the production of honey according to States, and of the honey and pollen plants reported by States. The English, or rather American, name is given followed by the botanical. In addition, charts are given for a number of the States showing the dates of blooming of the different plants.

877. KOBEL, F. 581.162.3 : 634.11 + 634.13

Befruchtung und Fruchtbildung der Obstbäume. (Pollination conditions in Swiss orchards.)

Schweiz. Z. Obst-u. Weinb., 1940, 49 : 131-43.

Factors unfavourable to fertilization of apples, pears, cherries, plums, apricots and quinces in Switzerland are described and lists are given of suitable pollinator varieties for the more important apples and pears.

878. ASAMI, Y. 634.1/7 : 581.162.3

A study of early pollination of fruit trees. [Japanese, English summary 2 pp.]

J. hort. Ass. Japan, 1940, 11 : 1-12, bibl. 14.

The author gives an account of work carried out by him in 1939 at Okitsu, Shizuoka, on the pollination of kaki, pear, plum and peach flowers when still in the bud. *Kaki*.—The flowers of

Fuyu were pollinated one or two days before opening with Zenjimarū pollen. The amount of seed obtained by pollinating 2 days early was reduced by more than 40%, but pollinating only one day earlier resulted in 83% of the amount of seed obtained by pollination in bloom. Hence pollination in bud is suggested as a practical method of reducing the trouble of bagging for pollination. *Japanese pear*, Nijisseiki.—Bud pollination with Chojuro pollen resulted in 90·8% amount of seed from pollination in bloom. It can therefore be recommended. With both pears and kaki the diminution effects were severer on average number of seeds per fruit than on fruit set. *Plum*.—Diminution in seed of Sordam pollinated with Santa Rosa was more than 50%. *Peach*.—Fruit set in bud pollination of Hakuto by Phillips was lower than in Hakuto bud pollinated with Tuscan.

879. HOUGH, L. F. 581.162.3 : 634.11
The pollen value of 134 apple varieties as determined by germination tests and field trials.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 133-6, bibl. 3.

McIntosh and Rhode Island Greening apple trees growing under good cultural conditions at three places in New York State were pollinated by the branch unit method with Delicious pollen, and in each orchard the average set of the branches concerned was used as a common denominator with which the set obtained with varieties in that orchard was calculated as a percentage of the Delicious set in that orchard. The data obtained concerned some 134 varieties and emphasize the fact that many factors other than pollination influence final fruit set and that under certain favourable conditions a nearly commercial crop may result even with triploid pollen if there is plenty of it.

880. (i) MACDANIELS, L. H., AND HILDEBRAND, E. M. 634.11 : 581.162.3 : 632.952
A study of pollen germination upon the stigmas of apple flowers treated with fungicides.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 137-40, bibl. 2.

- (ii) MAGNESS, J. R., BATJER, L. P., AND HARLEY, C. P. 634.11 : 581.162.3 : 632.952
Spraying apples for blossom removal.
Ibidem, 37 : 141-6, bibl. 1.

- (iii) GARDNER, V. R., MERRILL, T. A., AND PETERING, H. G. 634.11 : 581.162.3 : 632.952
Thinning the apple crop by spray at blooming : a preliminary report.
Ibidem, 37 : 147-9.

- (v) HOWLETT, F. S. 634.11 : 581.162.3 : 632.952
A preliminary report of experiments designed to limit the amount of fertilization in the apple.
Ibidem, 37 : 150-1.

(i) In the first of these studies in New York State it was found that 2-6-100 bordeaux, 20-80 copper-lime dust and "mike" sulphur reduced but did not inhibit the growth of pollen upon the stigma. On the other hand Elgetol at ·25% altogether prevented pollen germination on the stigmas.

(ii) An account is given of trials in West Virginia and at Wenatchee, Washington, of different tar oil distillates and in West Virginia only of di-nitro-ortho-cyclo-hexyl-phenol in oil for the total or partial prevention of set of fruits in apple orchards. Results show that one application of spray will entirely prevent set in some varieties and partially prevent it in others.

(iii) Of the materials used at East Lansing, "Dow Dormant", a commercial preparation of di-nitro-cyclo-hexyl-phenol proved most effective used at a concentration of 0·25% and 0·5%.

(iv) The last article which is merely an abstract of a paper to be produced elsewhere, contains notes of greenhouse and orchard tests with various waxes and sprays. No treatment was particularly successful.

881. NEBEL, B. R. 581.162.3 : 634.1/2
Longevity of pollen in apple, pear, plum, peach, apricot and sour cherry.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 130-2, bibl. 4.

In Nebel's trials at Geneva, N. Y., pollen was kept under conditions which are considered optimum, viz. 50% moisture at 2° to 8° C. in desiccators over sulphuric acid opened every 6 months

without control of atmosphere and without light. Under such conditions it was found that apple pollen may live more than 4 years. Pear pollen produced viable seeds after 3 years and the experiment continues. Hexaploid plum pollen was found as good as apple or pear pollen after 3 years, but peach and apricot pollen showed marked degeneration after 2 years. Sour cherry (Montmorency) pollen has so far survived in a viable state up to 5½ years. The longevity data run somewhat parallel with the chromosome numbers, i.e. 17 in apple and pear, 24 in plum, 16 in sour cherry as against 8 in peach and apricot.

Growth and nutrition.

882. NAGASAWA, K. 634.13-2.19
Physiological studies of the effects of bagging upon the fruits of the Japanese pear. 4th Report. Influence of double-bagging with various combinations of paper on the development of corky lenticels. [Japanese.]
J. hort. Ass. Japan, 1939, 10: 221-41, bibl. 18.

In continuation of his experiments on the prevention of corky lenticels in Japanese pears [*Ibidem*, 9: 165, *H.A.*, 10: 6] the author in 1937 and 1938 used combinations of cellophane, hatron and newspaper for bagging the fruits of four varieties of pear. Any two materials were combined, one being used inside and the other outside. Bagging took place about mid-May. As a control, fruits were also bagged in cellophane only, in hatron only and were left unbagged. In one variety, Nijisseiki, the type of bag had no effect on corky lenticels. But in such varieties as Kozo, Chojuro and Ako development depended greatly on the arrangement of the bagging material. With cellophane outside and newspaper or hatron inside the result was almost the same as when newspaper or hatron was used alone. With cellophane inside, however, the corky lenticels were greatly developed, their size being almost the same as when bagged in cellophane only. This difference is obviously due to atmospheric differences inside the bag or, in other words, to the humidity. In view of the fact that there is apparently no effect on corky lenticel development whatever arrangement of newspaper or hatron is made it may be assumed that humidity has an important bearing on the development of these lenticels. This confirms an earlier hypothesis.

883. v.D.V., P. 634.1/7-1.55
 Op welke wijze kan de vruchtzetting bevorderd worden. (**How fruit set can be promoted.**)
Fruittceelt, 1940, 30: 21-5.

Some of the accepted causes of poor fruit set are enumerated, such as June drop, absence of compatible pollinators, incompatible or too vigorous stocks and so on. The author agrees that any of these may be involved but considers that more often than not in Holland a poor fruit set (of pears in this case) is due to too much wood in the tree. He proceeds to discuss a number of instances in which the cutting out of much wood and a reduction of the number of spurs and the introduction of short spur pruning have turned a poor bearing tree into a good cropper.

884. HARLEY, C. P., AND MOORE, J. E. 634.11-1.55
Preliminary studies on the effect of tar oil spray for the prevention of fruit set in apples.
Proc. 35th annu. Meeting Washington St. hort Ass. 1939, Wenatchee, Wash., 1940, pp. 54-7.

The object of the experiments was to discover a spray which would prevent apple trees from setting a crop, but without causing permanent injury to the remaining tree tissues. The uses of such spray would be complete elimination of the crop for economic reasons, partial control of production to break biennial bearing, or the control of certain insect pests such as codlin moth. Tar oil alone was used at 2% concentration of actual oil, spraying began at cluster bud stage and continued at intervals until 3 days after full bloom. The fruit drop is caused by injury to the pedicel and therefore the spraying must be thorough. The most effective results without

much damage to leaves or spurs were obtained at late cluster bud stage, i.e. when the central flower is just beginning to open.

885. THOMPSON, C. R.

634.11-1.55

Biennial bearing of apple trees. Principles governing its treatment.

Fruitgrower, 1940, 89 : 128, 150.

The essential aim in the correction of biennial bearing is to obtain a good leaf surface early in the season during a cropping year in order to save any serious drain upon the carbohydrate level necessary for blossom bud formation. Current suggestions for doing this are discussed, e.g. drastic reduction of blossom during the on year or reduction of spurs or spur size during the off year. The author considers spur reduction should take place (a) when the spur systems are complicated and show indications of having almost a completely off year; (b) when the trees are somewhat weak and an improvement in blossom set might be obtained by stimulating tree vigour. Caution is advised in spur reduction on trees showing a sprinkling of bud. In such cases stimulation by manuring and tillage is preferable. Spur reduction *before* the off year is justified if done late in the season when the blossom buds are visible. By late pruning the pruner would avoid any spur reduction which involves serious blossom bud reduction and there would then be the probability of an enhanced set. The blossom buds however are often at the extreme end of the spurs and great care is needed to reduce the size of the spur units while retaining the blossom buds. On trees in which the spur system has been kept simple, i.e. limited to one bud each, but which still are biennial, fruit bud rubbing is suggested and this should be practised yearly. The object is to leave a sufficient number of spurs as leaf-producing units only in order to establish blossom bud for the following season. As regards time taken, an experiment in which 4 trees were rubbed while an expert pruner pruned 4 similar trees resulted in only 5 minutes difference, but the pruned trees had to be fruit thinned later, a process occupying 4 hours. The bud rubbed trees had a better leaf surface and fruit of superior size and weight. To sum up it should be the object to leave enough new wood in a tree each season for the production of leaf surface and the annual development of blossom bud. In seasons of surplus blossom bud rubbing should be practised to provide leaves early in the season to maintain regular cropping, and spur shortening should be carried out to maintain adequate fruit size.

886. TURNBULL, J.

634.1/2-1.55-1.542

Biennial bearing. Effects of cultivation and pruning.

Fruitgrower, 1940, 89 : 371-2.

The most common cause of biennial bearing is starvation, of which the cause may be damage by pests and diseases, lack of soil fertility, etc. However, the application of manures is no easy remedy, since not only must correct balance be obtained but the balance differs with the season and with varieties, probably interplanted. The tree performance should be closely watched and the manurial treatment varied accordingly. Many experienced fruitgrowers are very successful in this. Manuring, cultivation and spraying will not achieve regular bearing unless wood is produced on which fruit buds can form. The East Malling method for correcting biennial bearing is approved. This consists in cutting hard before the off year and leaving the laterals so produced for fruit bud formation in the on year. Some of these laterals are cut back hard every year so that there are always some growing, some forming bud and some forming fruit. An alternative method is to cut less hard and disbud instead before the on year. Both these methods have been particularly successful on Laxton's Superb and Cox's Orange, and are suitable for any variety that forms fruit buds on the young wood, as most do when well managed.

887. BUGINI, F.

581.145.1/2 : 634.11 + 634.13

La differenziazione delle gemme nel pero e nel melo. (Bud differentiation in the pear and the apple.)

Riv. Frutticoltura, 1940, 4 : 9-26, bibl. 3.

The author first sketches the technique used and then proceeds to give an account, with microphotographs, of development of both fruit and wood buds in pear and apple. He has worked as regards apples chiefly with Ananas Reinette and for comparison with A. Longone, Cellini, Reinette of Canada and Ontario, and in pears with Louise Bonne d'Avranches, with Beurré Hardy, Monsallard and Duchesse d'Angoulême for comparison.

888. STOY, O. 634.22 : 581.143
 Vad gör man med vattenskotten. (**Water shoots of fruit trees.**)
Frugtlödlaren, 1940, No. 1, pp. 9-12.

It is shown that water shoots can produce fruit buds and spurs and that their functions are extremely important in the early life of grafted trees.

889. SEREISKY, A. S. 634.13 : 577.15.04 : 581.163
The effect of hormones on fruit formation and problems of experimental parthenocarp. [Russian, English summary 36 lines.]
Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 115-27, bibl. 35.

Accounts of 1936/7 plant hormone experiments at the Moscow Botanical Garden. Two specimens of *Pirus communis caucasicus* trees, aged thirty-five, supplied all fruits and flowers for the study during both years. The first set of experiments consisted of removal of ovules from the small fruits and of their substitution by (1) ovules removed from other pears or apples, (2) pollen of *Coelogyne Massangeana*, (3) lanolin, (4) lanolin + 0.05% phenylacetic acid. Controls remained empty after the removal of ovules. In parallel experiments ovules were removed only from one longitudinal section of small pears, the other half being left as control. Results of these experiments, which are briefly noted, pointed to the possibility of inducing parthenocarpic development in fruits by introducing other growth stimulants in place of the fertilized ovules. In 1937 pear flowers were (1) emasculated in the cluster stage and not pollinated. (2) As in (1) but in addition stigmas and styles were removed. (3) As in (2) but at the cut the flower was covered with pure lanolin. (4) As in (3) with a substitute of 1% heteroauxin paste for lanolin. (5) Ditto, but with 0.5% heteroauxin paste. (6) Ditto, with 0.1% heteroauxin paste. (7) Ditto, with 0.1% phenylacetic acid. (8) Emasculat. Stigmas left on the flower. Pollination with pollen from other flowers of the same tree. (9) Controls: untreated, free pollinating flowers. The results were as follows:—Out of 68 non-pollinated flowers only one [in lot 3] was found to develop. Heteroauxin paste lots gave an average fruit set of 23.5% (20 flowers out of 85) and phenylacetic acid 28% fruit set. There was little difference in development of the normal and parthenocarpic fruits during the season nor did the fruits differ in flavour or appearance. Internally parthenocarpic fruits differed from normal ones in that they had a less developed seed case and more fruit flesh.

890. WEINBERGER, J. H. 634.25 : 577.15.04
Studies on the use of certain dinitrophenol compounds to break the rest period in peach trees.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 353-8, bibl. 2.

Successful experiments were carried out in Georgia in the 1937-8 and 1938-9 seasons with dinitrophenol (DN) and dinitro-o-cyclohexylphenol (DNO) in the attempt to break the rest period in peaches. DN was not quite so stimulating as DNO, but it did not injure the twigs. Other chemicals were tried but with less success. The optimal date for spraying was very important and was found to vary widely with variety, latitude and severity of winter. If applied a few weeks too early eventual retardation of development resulted. If applied only a few days too early or too late the effectiveness of the spray was lost. The optimum time extended over a period of only a few days. Expressing the optimum dates in terms of previous cold weather the sprays were most effective with one variety (Hiley) at Fort Valley in 1939 when approximately 600 hours of temperatures of 45° F. or below had accumulated, and with others after 800, 650, 800 and 900 hours respectively. At Albany rather less cold accumulation seemed to be necessary.

891. (i) GARDNER, F. E., MARTH, P. C., AND BATJER, L. P. 634.11-2.19 : 577.15.04
Spraying with plant growth substances for control of the pre-harvest drop of apples.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 415-28, bibl. 11.
 (ii) McCOWN, M., AND BURKHOLDER, C. L. 634.11-2.19 : 577.15.04
Very dilute α -naphthalene acetic acid spray and fruit drop.
Ibidem, 37 : 429-31, bibl. 1.

- (iii) MURNEEK, A. E. 634.11-2.19 : 577.15.04
Reduction and delay of fruit abscission by spraying with growth substances.
Ibidem, 37 : 432-4, bibl. 1.
- (iv) SOUTHWICK, L. 634.11-2.19 : 581.192
Spur nitrogen and pre-harvest McIntosh drop.
Ibidem, 37 : 435-7, bibl. 9.
- (v) HOFFMAN, M. B. 634.11-2.19 : 581.192
The pre-harvest drop of mature McIntosh apples as influenced by applications of nitrogen-carrying fertilizers.
Ibidem, 37 : 438-42, bibl. 4.

(i) Naphthaleneacetic acid and naphthaleneacetamide proved the most effective of the substances used in experiments made at Beltsville, Md., to determine the effect of growth substances in preventing pre-harvest drop of apples. Their effect on most varieties (McIntosh is an exception, the effect being much shorter with this variety) was found to reach a peak in 5 or 6 days and to persist for 2 or 3 weeks. They are therefore best applied as the drop begins in order to utilize their greatest period of effectiveness. Further applications as the effect wears off prove equally effective. The control of fruit drop cannot be more effective than the cover given, hence the desirability of thorough spraying with special attention to hitting the fruit. Application by means of injections was unsuccessful and soil applications were also somewhat ineffective. The spray resulted in excellent colour of fruit. Early sprays applied at petal fall and 3 weeks later were without effect.

(ii) Although the drop of fruit was significantly greater from unsprayed halves of Delicious apple trees than from the halves sprayed with a spray containing .0001% α -naphthaleneacetic acid the research workers concerned at Lafayette are inclined to attribute this difference to weather conditions. Other trials with this .0001% solution were ineffective.

(iii) Spraying Delicious and Winesap apple trees at Columbia, Mo., with α -naphthaleneacetic acid and α -naphthylacetamide at concentrations of .0005% and .001% resulted in marked reduction of fruit drop.

(iv) Indications are given by experiments at Amherst, Mass., that variability in fruit drop in individual trees and among apples on individual trees may be due to differential nitrogen contents of bearing spurs. Results strongly support the evidence of field experiments that a high state of fertility, especially with regard to nitrogen, tends to increase pre-harvest drop of McIntosh apples.

(v) Data from fertilizer tests at Ithaca indicate that applications of fertilizers calculated to allow the tree to get excessive amounts of nitrates during the latter half of the growing season increase the pre-harvest drop of McIntosh apples. It is suggested that a strong growth of sod or a summer cover crop would reduce soil nitrates and so prevent excessive drop.

- 892. ANON. 634.11-2.19
Apple drop reduced by use of spray.
Bett. Fruit, 1940, 34 : 8 : 8, 19.

Results obtained in preventing fruit drop of apples by spraying with growth substances are summarized. No indication is given of where or by whom the experiments were conducted. They were apparently successful.

- 893. (i) CHILDERS, N. F., AND SCHNEIDER, G. W. 634.11 : 581.132
The effect of water supply on the rate of photosynthesis, transpiration and respiration of apple leaves.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 365, bibl. 1.
- (ii) PICKETT, W. F., AND KENWORTHY, A. L. 634.11 : 581.132
The relationship between structure, chlorophyll content and photosynthesis in apple leaves.
Ibidem, 37 : 371-3, bibl. 4.
- (iii) SOUTHWICK, F. W., AND CHILDERS, N. F. 634.11 : 581.132 : 632.952
The influence of bordeaux mixture on the rate of photosynthesis and transpiration of apple leaves.
Ibidem, 37 : 374, bibl. 2.

- (iv) MURPHY, L. M. 634.23 : 581.132 : 632.952
The effect of certain fungicides on the photosynthetic activity of sour cherry leaves.
Ibidem, 37 : 375-8, bibl. 6.
- (v) AGNEW, E. L., AND CHILDERS, N. F. 634.11 : 581.132 : 632.952.1
The effect of two mild sulphur sprays on the photosynthetic activity of apple leaves.
Ibidem, 37 : 379-83, bibl. 12.
- (vi) CHILDERS, N. F., AND BRODY, H. W. 634/635 : 581.084.1 : 581.132
An environment-control chamber for study of photosynthesis, respiration and transpiration of horticultural plants.
Ibidem, 37 : 384-90, bibl. 5.

Articles (i) and (iii) will be issued in full in *Plant Physiology*. (ii) Work at Manhattan, Kansas, indicates that the extent of the internally exposed leaves is more important than chlorophyll content as a factor governing photosynthetic activity in apple leaves. (iv) An account is given of trials at East Lansing to determine the effect on photosynthesis of new proprietary copper sprays in comparison with that of lime-sulphur and bordeaux. (v) Experiments at Columbus with Stayman, McIntosh, Baldwin and Turley apples confirm previous evidence that sprays containing sulphurs in suspension have less effect on photosynthesis of apple leaves than sprays containing sulphurs in solution. (vi) Full details with illustration and plan are given of a controlled-environment chamber successfully used in the Horticulture and Forestry Building at Ohio State University. Inside dimensions are 7×8×8 feet high. It is possible in it to maintain a temperature within 1½° F. over a range of 35 to 120° F., a relative humidity within 1% over a range of 0 to 95%, and light from 500 foot candles at floor level to 8,000 near the ceiling.

*Manuring.**

894. ROACH, W. A. 581.111 : 634.1/2-2.19
Diagnosis of mineral deficiencies and excesses by systematic leaf injection and analysis.
A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 51-8, bibl. 11.

In introducing this fascinating report on different phases of his work the author writes as follows : "The system evolved at East Malling Research Station for studying the mineral nutrition of plants is based on the fact that a satisfactory supply of minerals in the leaf is essential for the health of the whole plant because it is there that the raw materials of the general metabolism of the plant are synthesized. The minerals actually present can be ascertained by analysis of the plant and their adequacy can be tested by watching the effect of introducing supplementary amounts of the minerals one or more at a time."

Injection.—Details are given of preliminary work and results. The latter have included the diagnosis and cure of deficiency symptoms, the inducement of health in very poor trees and the setting up of resistance both to disease and insect attack. The plant material has included apples, pineapples, plums, cherries, etc. The results of 1,175 injections in the orchards of South Africa are tabulated according to chemical used, number of injections made and number of beneficial responses obtained. It was possible to check results by the results of manurial trials and practical experience. The elements injected were N, P, K, Ca, Mg, Zn, Fe, Mn, Cu, B, Ni and Co. The practical results include, among others given in some detail, the diagnosis and cure of a manganese-deficiency chlorosis in peach trees. A description is given of the trials made with these different elements and of the magnitude of the response made to their injection.

Mineral Analyses.—Analytical methods are being developed and used for 6 main purposes :—(1) As a guide to injection. (2) To study the effects of high concentrations of minerals, for which injection methods are not quite adequate. (3) For testing the adequacy of minerals having functions other than photosynthetic. (4) For use late in the season when injection gives no response. (5) For studying trees which cannot be injected but from which samples can be taken, stored and analysed at leisure. (6) For the recognition of excesses of minerals. Examples are given of the use of the methods.

* See also 826-840.

Analytical methods.—The methods consist of (1) Flame spectrographic method, being an adaptation of Ramage's method by Roach and Majewsky. (2) Spark method devised by the author and consisting of sparking in argon minute electrodes prepared from the plant material without addition of any foreign substance. (3) Polarographic method. (4) Chemical methods. The results achieved by the different methods with some 34 elements are tabulated. Brief notes are given on the planning of field work.

The author sums up as follows :—"The mineral status of plants may be determined rapidly by either or both of two complementary methods : plant analysis and plant injection ; and mineral deficiencies in large plants such as trees may be made good commercially by plant injection.

Injection.—By appropriate methods, nutrient or other (e.g. antiseptic) solutions can be introduced into any part of a living plant. This part may range, as desired, from a selected area of a single leaf to the whole plant. By localized injections and a study of the response a rapid diagnosis (two to seven days) of nutritional deficiencies may be obtained and by whole tree injections curative treatment may be carried out which gives quick results with the expenditure of small quantities of materials. These methods have been used to study mineral deficiencies, the relation between the nutrient salts present in the soil and those actually present in the leaves, and in the treatment of certain diseases either with nutrient salts or with antiseptics. Good results have been obtained in the treatment of silver leaf and red spider. In an extensive series of experiments carried out in South Africa the value of the methods both for diagnosis and treatment was confirmed, and results of great commercial value were obtained. Peach trees, for example, which produced no crop before injection produced a crop worth £2 to £5 per tree after an injection costing 2d. per tree. *Leaf Analysis.*—Spectrographic and chemical methods of leaf analysis have been evolved which are extremely rapid and sufficiently accurate for a number of elements—spectrographic for lithium, sodium, potassium, rubidium, caesium, copper, silver, lead, chromium, manganese, iron, magnesium, calcium, strontium, barium, molybdenum, cobalt and nickel, and chemical for phosphorus, nitrogen, and silicon. Special methods of analysis for the separation of individual elements into the portions which fulfil different functions in metabolism are being developed. It has been possible to study mineral deficiencies, the relation existing between soil and plant and to make good mineral deficiencies by injection."

895. THOMPSON, S. G.

535.33 : 581.192

The study of mineral deficiencies and excesses by spectrochemical methods.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 86-8.

Deficiencies of elements such as iron, manganese, zinc, etc., which occur in minute amounts, have been found to be of as great economic importance as deficiencies of the major elements N, P and K. The minute quantities in which they occur demand methods of determination different from the normal, and of these that of spectrochemical analysis is the most promising, being very economical of time, money and material once the expensive apparatus necessary has been set up. Such analysis is based on the fact that many elements, when raised to a sufficiently high temperature, emit light of "colours" characteristic of the element. If this light is passed through a prism it is separated into its constituent colours. This spectrum can be photographed, each colour appearing as a line ; the relative position of this line to others is fixed ; and so examination of the photograph tells what elements are present and the density of the lines shows in what amount. Healthy plant material of the same sort collected in different places shows very similar spectra, but spectra of leaves from unhealthy trees may differ widely from those of healthy trees of the same variety in the same plantation. Three types of problem common to the fruitgrower can therefore be cleared up, viz. (1) deficiencies of one or more elements, (2) excess of one or more elements, (3) cases of "lime-induced chlorosis" in which the balance of several elements may be abnormal.

896. DAVIS, M. B.

634.11-1.8

Balanced fertilizer for apples.

Bett. Fruit, 1940, 34 : 11 : 1, 8, 14, 15, 18.

The importance of a balanced ration for plants is stressed. Continuous nitrogen applications may result in a potassium or general mineral deficiency ; continuous phosphorus in potassium deficiency ; continuous lime in carbonate form a deficiency of iron ; in sulphate form it might

interfere with potassium intake and cause certain physiological disorders in fruits ; continuous potassium might, though less certainly, cause magnesium deficiency. Lack of nitrogen is expressed by small, pale foliage and short growth ; excess of nitrogen by large, dark green leaves puckering at the tip with browning or burning ; excess nitrogen can be neutralized by an available supply of potassium. Lack of potassium is shown in fruit by a muddy instead of a lively green ground colour and in the leaves by a browning or scorch of the older or basal leaves, presenting at the end of the season a typical cigar-ash grey appearance on the extreme margin, while the tissue next to the scorch will be olive green. Phosphorus deficiency symptoms are scarcer but in a severe stage the trees lose their fruit and leaf buds, the foliage is dull, and in summer shows purple and bronze. Calcium deficiency in the field is rare, symptoms in pot culture are large and luxuriant foliage at first, becoming normal and showing dead patches on margins and centre. Excess of lime leads to physiological troubles such as cork. Magnesium deficiency is distinguished from potash deficiency by the clear nut brown colour of the scorch, not reddish brown or ash grey, and the patches will be distributed all over the leaf, while the area adjoining the scorch is normal green or chlorotic rather than olive green.

897. OVERLEY, F. L., AND OVERHOLSER, E. L. 634.11-1.84
The effect of certain forms of nitrogen carriers upon the response of Rome Beauty apples.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 78-80, bibl. 2, and 634.11-1.84
The effect of time of nitrogen applications upon the response of Jonathan apples.

Ibidem, 37 : 81-4, bibl. 6.

The above experiments were carried out near Wenatchee, Washington, on 23-year-old Rome Beauty and 22-year-old Jonathan trees. Under a cover crop of alfalfa it appeared to matter little whether nitrogen was applied as calcium nitrate, whale meal and blood, calcium cyanamide or ammonium sulphate, to Rome Beauty trees. As regards time of application of N to Jonathan trees* February and December appeared to be the most suitable times.

898. BATJER, L. P., AND DEGMAN, E. S. 634.11-1.8
Effects of various amounts of nitrogen, potassium and phosphorus on growth and assimilation in young apple trees.

J. agric. Res., 1940, 60 : 101-16, bibl. 15.

In February 1937 seventy-two 1-year whips of York Imperial apples, grafted on French seedling piece roots, were selected for uniformity in the nursery row and brought to the greenhouse for potting. They were cut back to 2 buds above the graft union and the roots were hard pruned. Each tree, after weighing, was planted in a 3-gallon glazed earthenware crock in pure washed sand ground to medium fineness. Drainage was afforded through a hole in the base of the crock. Standard amounts were supplied of the elements other than N, K and P. Of these the following concentrations were used :—Nitrogen 0, 2, 5, 15, 30, 60, and 168 p.p.m. Potassium 0, 2, 4, 10, 30, 60 and 117 p.p.m. and phosphorus 0, 2, 4, 10, 20, 40, and 93 p.p.m. Trees grown with nitrogen at 60 p.p.m. made somewhat less growth, as measured by total linear growth and total fresh weight, than trees grown with 168 p.p.m., though the differences were not statistically significant. Concentrations of nitrogen below 60 p.p.m. reduced the amount of growth almost quantitatively, the largest difference in growth resulting at concentrations between 15 and 30 p.p.m. Potassium at 60 p.p.m. gave less growth than at 117 p.p.m., and less growth with each decreasing concentration. The greatest difference in growth occurred between 4 and 10 p.p.m. Growth with 2, 4, 10 and 30 p.p.m. was not decreased as much as with corresponding concentrations of nitrogen. Definite deficiency symptoms in the potassium series did not occur on trees receiving 10 p.p.m. or more, although growth increased with increasing concentrations until more than 60 p.p.m. were supplied. In the phosphorus series, growth was approximately uniform in all treatments receiving 4 p.p.m. or more of this element. Only when phosphorus was completely lacking did visible symptoms of deficiency occur. The nitrogen and potassium content of the plant tissues, particularly of the leaves and bark, increased with increasing concentrations of these elements in the nutrient solution. The potassium content of leaves and

* Originally under alfalfa which was, however, gradually reduced to weeds and grass by annual discing.

bark in the nitrogen series and the nitrogen content of these tissues in the potassium series were found to be independent of differential treatment. The rate of photosynthesis per unit of leaf area was markedly reduced in the nitrogen series with decreasing amounts of this element in the nutrient solution. A similar but less marked decrease occurred in the potassium series. A significant decrease in assimilation occurred in the phosphorus series only with the complete absence of this element. Trees grown at a low nitrogen level until the terminal bud had formed were supplied with a high nitrogen solution in late August. Carbon dioxide assimilated per unit area of leaf was measured periodically prior to and immediately following the application of the higher nitrogen solution. Leaves became noticeably greener within a few days after additional nitrogen was supplied. Carbon dioxide assimilation per unit area of leaf significantly increased during this period, and 21 days after application of increased nitrogen it had doubled in most cases. The increase in nitrogen content of the leaves was closely correlated with the increase in assimilation. [From authors' summary.]

899. CULLINAN, F. P., AND WAUGH, J. G. 634.25-1.83

Response of peach trees to potassium under field conditions.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 87-94, bibl. 5.

Experiments on Elberta peaches at Beltsville, Md., in gravelly loam to sandy loam soils suggest that leaf diagnosis may well indicate what trees are likely to respond to potassium fertilizers in peach trees showing potassium-deficiency symptoms. The indications of such analysis, especially in conjunction with the application of nitrogenous fertilizers to soils of low available potassium content, are discussed.

900. LILLELAND, O., AND BROWN, J. G. 634.25-1.85

The phosphate nutrition of fruit trees II. Continued response to phosphate applied at the time of planting.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 53-7, bibl. 2.

In a very phosphorus-deficient soil at Paradise, Calif., placing 10 lb. treble superphosphate in the planting holes resulted in increased growth of peach trees which was evident 3 years after planting.

Soils and cultural operations.

901. AYLEN, D. 634.1/2-1.543

Contour planting and terracing of orchards.

Bull. Minist. Agric. S. Rhod. 1148, reprinted from Rhod. agric. J., 1940, 37 : 196-288.

Descriptions are given of 4 different methods of effecting soil conservation in orchards. (1) Bench terracing, a somewhat expensive method useful on a small scale. (2) The evolution of specially designed contour ridges to form bench terraces; a most satisfactory method for large orchards. (3) Normal type contour ridge for relatively flat slopes. (4) Contour planting of trees with strips of permanent cover between the rows. The methods of constructing Nos. 1 and 2 are fully described and illustrated.

902. LIJFTOGT, G. 631.415 : 634.1/7

Over fruitteelt en zuurgraad van den grond. (Fruitgrowing and soil acidity.)

Fruitteelt, 1940, 30 : 17-21.

On sandy humus soil in Holland the pH is normally too low for fruitgrowing and the general opinion that a pH of 5.5 is ideal for fruitgrowing in Holland is here disputed. Several instances are given whereby raising the pH to neutral (7) has resulted in a great improvement in yield and in the return to normal of yellow-leaved, stag-headed fruit trees. Continuous green manuring increases the acidity of the ground and should be accompanied by liming.

903. THIES, W. H. 634.1/7-2.951 : 631.415

Effects of heavy applications of dusting sulphur on soil acidity and cover crop in an orchard.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 76-7, bibl. 2.

Experiments in Massachusetts indicate that where sulphur is dusted to a large extent it may occasionally be necessary to lime the soil in order to offset the acidifying effects of the sulphur.

904. BREGGER, J. T., AND MUSSER, A. M. 634.1/2-1.874
Observations on effects of soil covers* as conservation practices on peach orchards.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 1-6, bibl. 8.

The authors discuss the literature on peach cover practice in the U.S. and note the accumulating evidence that certain conservation practices, including continuous vegetative and mulch covers, modified sod, or simply a short annual period of cultivation are successful. These practices are divisible into two groups, (a) continuous grass or legume sods, either solid or in strips, (b) mulches. Among grasses used is Bermuda grass, sometimes allowed to cover only part of the orchard at a time. Mixed covers of orchard grass, clover and Korean lespedeza have been found successful. This annual lespedeza seems to be the most successful as a continuous cover crop in bearing peach orchards. Nitrogen fertilizer is used liberally with it. Many examples of the use of this legume are given. Certain principles appear to be clearly defined. The competition of vegetative covers seems to be almost universally harmful to young peach trees but not to older trees. The degree of slope and the amount of erosion are other important factors, since the former may determine whether a sod cover will conserve more or less additional rainfall than it utilizes for its own growth. The type of cover crop is also important, i.e. its depth of rooting and type of top growth as affecting moisture penetration. The time element is important and unless an autumn planted cover crop can give good winter protection its use can hardly be justified. The necessity of extra nitrogen to meet the cover crop's individual needs is shown. Nitrogen intended primarily for the trees can be put where wanted instead of broadcast. Contour practices such as basins, ridges or terraces will allow a more extensive use of cover crops. Mowing cover crops leaves more moisture for the trees. A partial or temporary reduction of area under cover crop, provided this does not allow erosion to start, tends to prevent injurious competition with the trees. The practice of mulching increases moisture penetration and the accumulation of nitrates and potash, but necessitates additional nitrogen being given.

905. REBOUR, H. 631.67: 634.1/7
L'irrigation des arbres fruitiers. Degré d'humidité optimum. (Optimum degree of moisture in fruit tree irrigation in North Africa.)
Fruits Primeurs, 1940, 10: 103-4.

The article contains practical advice on irrigation for N. African cultivators. The questions asked and answered are: (1) When is it necessary to water? (2) How much water at each irrigation? The answer to (1) is:—Leave as long a period as possible between waterings but not long enough to allow the trees to suffer. Signs that water is required are a slight flagging of the leaves and an almost imperceptible change of colour, both observed early in the morning. The plantation which is always the first to wilt should be used to supply the signs. The famous "irrigation sense" is merely the ability to detect signs unnoticed by the less observant. (2) For any given soil the quantity of water per irrigation should be immutable, but the frequency of irrigation is variable and depends on transpiration. The soil is deemed to have the correct amount of water when it is moist at a depth of 1.80 m. which should occur in 24-48 hours. This sounding by soil auger need only be done once, since once ascertained it serves as a guide for all future irrigations of that particular area.

906. BLACK, M. W., AND MICKLEM, T. 634.25-1.543.1
The effect of shading on tree growth, fruit development, and subsequent storage behaviour ("woolliness") of the Peregrine peach.
Sci. Bull. Dep. Agric. S. Afr. 194, Stellenbosch-Elzenburg Series 34, 1939, pp. 22, bibl. 9.

Experiments conducted in the western Cape Province showed that peach trees shaded or partially shaded during the dormant period behaved more normally with respect to blossoming, foliation, shoot growth and fruit development than trees exposed to the rays of the sun. Furthermore, shading resulted in a considerable decrease of the amount of "woolliness" in Peregrine peaches after cold storage.

* See also 826-832.

907. TALBERT, T. J. 634.11-1.542

A comparison of pruned and unpruned apple trees.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 113-5, bibl. 8.

Modified leader pruned apple trees overtook unpruned trees in yield in the 15th year from planting at Columbia, Mo., and should now continue to outyield them. Open centre trees are now, in the 16th year from planting, tending to catch up the unpruned trees. Open centre pruning had the greatest dwarfing effect on growth as measured by heights, spreads and girths.

908. SWARBRICK, T. 634.11-1.542

The effect of pruning for tree shape upon the yield of apples.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 20-3, bibl. 1.

Experimental data of previous years had indicated that the highest yields, in Cox, Worcester, Allington, Early Victoria, and King Edward apple trees were obtainable by pruning on the regulated system. In 1939, the 12th year from planting, a very heavy crop was obtained from all varieties except King Edward. The yields, moreover, were highest in Worcester, Cox and Early Victoria and second highest in the case of Allington when pruned on the modified leader system. Light pruning would then appear to be justified by results. A moderate to light pruning will give large trees in least time and will ensure early cropping. It is realized that at the present time certain orchards may be allowed to fall down to grass. If this is accompanied by light pruning the next crops may be so heavy as to cause the onset of biennial bearing. Light pruning must then be backed by adequate cultural attention and manuring to ensure reasonable tree growth, say a terminal growth of 8-14 inches a year. It is suggested that in order to be effective the nitrogenous dressing must be applied before the end of March and the pruning must remove at least half the last year's leader growth.

909. BARNETT, R. J., AND FILINGER, G. A. 634.1/7-1.542

Pruning fruit plants.

Circ. Kans. agric. exp. Stat. 197, 1939, pp. 27.

Specific directions on pruning apples, pears, peaches, sour cherries, plums and bush fruit plants in Kansas.

910. NATIVIDADE, J. V. 634.1/2-1.542

Sobre a poda das árvores de fruto. (Pruning fruit trees.)

Ser. Estudos tec. Minist. Agric. Lisboa 6, 1938, pp. 88.

A discussion of the theory and practice of fruit tree pruning. Results of research in various countries, chiefly America, is much quoted to support the author's remarks. The workers' names are given but there is no bibliography. The bulletin is not illustrated.

911. MURNEEK, A. E. 631.542.24 : 634.1/2

Fruit production as affected by branch ringing.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 97-100, bibl. 4.

Trials at the Missouri Experiment Station showed that, although the effect was not so great as with apple trees, ringing branches of pears, peaches and cherries in full bloom resulted generally in increased set, exceptions being the Golden Elberta peach and Montmorency cherry, where decreases were the result in very heavy crops. In every instance ringing increased the size of the fruit. Pressure tests with apples, pears and peaches at harvesting indicated that fruit from ringed branches was invariably more mature. Scoring, i.e. cutting with a sharp knife through the bark 2 or 3 times completely around the bark, was found almost as good as ringing in the two varieties tried. Wiring was not so successful.

912. LILLELAND, O., AND BROWN, J. G. 634.21-1.542.24

Fruit thinning I. The relationship of fruit size in unthinned apricot trees to crop and season.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 165-72.

Data are presented of observations on unthinned, uniform 16- to 17-year-old apricot trees, var. Tilton, at Davis, Calif., in 1938 and 1939. The average size of fruits was highly correlated with the number borne. The size was markedly affected by seasonal factors. There appears to be a minimum tree load below which appreciable improvement in the per cent. weight of

marketable fruit cannot be attained by thinning. This minimum is not changed in seasons of poor fruit size. In the trees examined thinning of fruit on trees with a tree load of less than 6,000 fruits would appear uneconomical. Nor would it seem possible for the apricot grower profitably to produce large-sized apricots in a poor sizing season.

913. ANON. 634.25-1.542.14
Big peaches grown by early thinning.
Bett. Fruit, 1940, 34 : 7 : 6.

Dr. Tukey's results at the New York State Experiment Station, Geneva, with the thinning of peaches are briefly summarized. Peaches should be thinned by fruit size and not by the calendar, and of the sizes tried that of $\frac{3}{4}$ inch length gave the best results in reducing June drop and in checking the biennial bearing habit. The yield in pounds per tree was reduced by thinning but the size and colour and thus the market value were improved.

Harvesting and marketing.

914. WARCOLLIER, G., AND TAVERNIER, J. 663.3 + 664.85
 État de maturité des pommes. . . . (The state of ripeness in apples. 1. Its importance in cider making and distilling. 2. A study of certain phenomena of metabolism during ripening.)
Ann. Tech. agric., 1938, 1 : 77-93, bibl. 28.

Experience and experiment at the Caen Pomological Station have shown the necessity for greater care in picking and storing cider apples. Fruits should be picked as late as possible to ensure quality. They must be kept under shelter from the weather. Both cider making and distilling will be more efficient and will need less fruit, the more attention is paid to these simple rules. Cider apples with their high tannin contents are found to emanate gases which have a distinctly retarding effect on the growth of tubers, germination of seed and growth of young plants. Ethylene treatment of unripe apples, which increases their sugar content by hydrolysis of amylaceous matter and other carbohydrates, would appear to be difficult of application and uneconomic in the case of cider apples.

915. MORRIS, O. H. 681 : 634.1/7
A fruit circumer.*
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 191-2.

A simple fruit measuring apparatus in use at the Washington State Experiment Station.

916. FISHER, D. V., AND BRITTON, J. E. 634.23-1.547.6
Maturity studies with sweet cherries.
Sci. Agric., 1940, 20 : 497-503, bibl. 3.

The authors report on a project which was started at the Summerland Experimental Station, B.C., in 1935 to study the changes in cherries prior to maturity and to devise some practical index for the determination of picking maturity. It was found that in the 15 days prior to optimum picking maturity of Bing and Lambert cherries there was a change in skin colour from light to dark red, an increase in soluble solids of 3% and an increase in weight of 37%. As a general rule a minimum soluble solids content of 19% for Bings and 17% for Lamberts was essential for good dessert quality. The development of dark red skin colour in these two varieties proved a reliable index of optimum picking maturity. A colour chart showing the proper colours at which to pick these two varieties and Deacon and Royal Ann was prepared.

917. CHRISTOPHER, E. P. 634.11 : 581.175.11
Experience with color development of apples after harvest.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 44-6, bibl. 1.

Experiments indicate that it may be good commercial practice to expose mature but poorly coloured apples to sunlight filtered through cheesecloth or similar material for 1-2 weeks after harvest.

* See also *H.A.*, 7 : 158.

918. MAGNESS, J. R., BATJER, L. P., AND REGEIMBAL, L. O. 634.11-1.84 : 581.175.11
Correlation of fruit color in apples to nitrogen content of leaves.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 39-42, bibl. 1.

Results with 105 Rome Beauty trees in their 8th growing year at Beltsville, Md, indicate a relationship between the N content of leaves at harvest time and fruit colour. Merely to obtain the best colour nitrogen applications should be as light as is consistent with satisfactory growth and yield.

919. ANON. 634.11-2.95 : 581.175.11
Thiocyanates and apple colouring.
Fruitgrower, 1940, 89 : 372.

Thiocyanate sprays applied during the growing season to the foliage of apple trees increases the quantity and quality of the colouring of the fruit. This does not occur immediately but over a period of weeks. Even apples which normally contain little or no red acquire a flush. Storage records show a superior keeping quality for the sprayed fruit. No early drop is brought on by the sprays and although there was noticeable leaf injury there was no premature leaf drop in autumn.

920. CHOWN, W. F., AND HOPPER, W. C. 658.8 : 634/635
The wholesale marketing of fresh fruits and vegetables in the City of Toronto.
Publ. Dep. Agric. Canada 673, 1940, pp. 58, being Tech. Bull. 23.
 REID, E. P., CAMPBELL, B. A., AND HOPPER, W. C. 658.8 : 634/635
The marketing of perishable farm products in Ottawa.
Publ. Dep. Agric. Canada 677, 1940, pp. 35, being Tech. Bull. 24.

Statistics are given in these two bulletins of vegetable and fruit products dealt with respectively in the Toronto market in the year 1935 and in the Ottawa By Ward market in the year ending 30 September, 1937, showing their source and method of delivery and disposal.

921. MANEY, T. J. 634.11-1.541.44
The growth and production of topworked apple varieties.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 287-90.
 Notes on intermediate stock effect.

ANDREWS, J. K. 631.541.11 : 634.1/2
Better root-stocks for fruit trees.
Minn. Horticulturist, 1940, 68 : 43, 57.

Various seedling apple rootstocks used in Minnesota.

YEAGER, A. F., AND LATIMER, L. P. 634.11-1.55
Tree girth and yield as indicators of subsequent apple tree productivity.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 101-5, bibl. 14.

McMUNN, R. L. 634.11 : 581.14
Growth increments in apple trees.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 106-9, bibl. 3.

MEADER, E. M., AND BLAKE, M. A. 634.25
Progress report on identification of peach varieties by leaf characteristics.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 203-7, bibl. 3.

UPSHALL, W. H. 634.25-1.536
Transplanting shock in peach seedling rootstocks and its effects on size of nursery and orchard trees.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 340-2.

UPSHALL, W. H. 634.25-1.542
Summer pruning of peach trees in the nursery row.
Ibidem, 37 : 343-4.

MERRILL, T. A. 634.1/7-1.8
Orchard fertilization.
Ext. Bull. Sta. Coll. Mich. 205, 1940, pp. 8.
 Principles of orchard manuring in Michigan.

- WAUGH, J. G., CULLINAN, F. P., AND SCOTT, D. H. 634.25-1.8
Response of young peach trees in sand culture to varying amounts of nitrogen, potassium and phosphorus.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 95-6, bibl. 1.
- MARTH, P. C., AND GARDNER, F. E. 634.25-1.541.11
Evaluation of variety peach seedling stocks with respect to "wet feet" tolerance.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 335-7, bibl. 2.
- WANDER, I. W., AND GOURLEY, J. H. 634.1/2-1.83 + 1.85
A study of lateral movement of potassium and phosphorus in an orchard soil.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 27-31, bibl. 8.
- REUTHER, W., AND BOYNTON, D. 634.1/2-1.83
Variations in potassium content of the foliage from certain New York orchards.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 32-8, bibl. 7.
- BATJER, L. P., BAYNES, W. C., AND REGEIMBAL, L. O. 634.11-1.8
The interaction of nitrogen, potassium and phosphorus on growth of young apple trees in sand culture.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 43.
- ACHARYA, C. N., AND SUBRAHMANYAN, V. 631.875
The hot fermentation process for composting town refuse and other waste material. I. Introductory.
Ind. J. agric. Sci., 1939, 9 : 741-4, bibl. 18.
- ACHARYA, C. N.
II. Some factors influencing the efficacy of the process. 631.875
Ibidem, 1939, 9 : 817-33, bibl. 3.
- UBER, F. M. 581.192.2
Microincineration and ash analysis.
Bot. Rev., 1940, 6 : 204-26, bibl. 74.
- BRUNSTETTER, B. C., MYERS, A. T., DIX, I. W., AND MAGOON, C. A. 634.8 : 581.192 : 535.33
A quantitative survey of eight mineral elements by a spectrographic method and of total nitrogen in young leaves of twenty-five varieties of American grapes.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 635-8, bibl. 2.
- MYERS, A. T., BRUNSTETTER, B. C., DIX, I. W., AND MAGOON, C. A. 634.8 : 581.192 : 535.33
A quantitative spectrographic determination of eight elements in young leaves of the Delaware grape.
Ibidem, 37 : 645-9, bibl. 2.

SMALL FRUITS, VINES AND NUTS.

922. CRANE, M. B. 634.71 : 575.1
The origin of new forms in *Rubus*. II. The loganberry, *R. loganobaccus* Bailey.
J. Genetics, 1940, 40 : 129-40, bibl. 13.
- THOMAS, P. T. 643.71 : 575.1
The origin of new forms in *Rubus*. III. The chromosome constitution of *R. loganobaccus* Bailey, its parents and derivatives.
Ibidem, 1940, 40 : 141-56, bibl. 9.

Crane's experiments lead him to conclude that the loganberry is, as originally supposed, a hybrid derived from an unreduced male germ cell of a raspberry, which is known to correspond to the diploid type, and a normal reduced germ cell of the blackberry, *R. vitifolius*. The second author is concerned with chromosome behaviour in the loganberry, its parents and derivatives.

923. CRANE, M. B. 634.71 : 575.1
Reproductive versatility in *Rubus*. I. Morphology and inheritance.
J. Genetics, 1940, 40 : 109-18, bibl. 15.
 THOMAS, P. T. 634.71 : 575.1
Reproductive versatility in *Rubus*. II. The chromosomes and development.
Ibidem, 1940, 40 : 119-28, bibl. 19.

The object of the first paper is stated to be the description of anomalies of breeding behaviour in *Rubus* which have come to light during experiments at the John Innes Institution. Reproductive behaviour in diploid and in polyploid forms is discussed. Results of experiments are discussed in relation to the taxonomy of *Rubus*. The author of the second paper discusses apomixis, its detection, mechanism, genetical implications and relation to polyploidy.

924. CLARK, J. H. 634.711-1.8
The effects of mulching red raspberries on growth and production.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 604-8, bibl. 4.

Experiments in dry soils of New Jersey with Ranere and Latham raspberries resulted in a greater total number of canes and more large canes on plots mulched with salt hay applied at the rate of 6 tons the first and 2-3 tons in subsequent years than on cultivated plots. Yields were usually greater under mulch. Roots were found at slightly greater depths under mulch. All plots received fertilizers.

925. BERRY, W. E., AND SWARBRICK, T. 634.723.1-1.535 : 577.15.04
The propagation of black currants from cuttings.
A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 24-30, bibl. 2.

The application of α -naphthaleneacetic acid, β -indolylacetic acid, phenylacetic acid and "Hortomone A" to black currant cuttings set in the field under winter conditions did not result in improved rooting. At this time controlled conditions of temperature and humidity are essential. Planting in February was no better than in November. Protective coverings, viz. vaseline, paraffin oil, paraffin wax, cuprous oxide, zinc oxide and 2½% and 5% solutions of cellulose acetate in acetone and dioxan, applied to the cuttings reduced rooting in most cases. Tip and basal cuttings taken in June were well rooted in a propagating frame by August without hormone treatment. Terminal cuttings with leaves were vastly superior to basal cuttings without leaves. Terminal, middle and basal cuttings taken in early September with leaves removed, all gave much improved rooting when treated with indolylbutyric acid. In the treated material the basal cuttings made most root growth. It is suggested that the importance of attached leaves lies in the production of root-forming hormones rather than carbohydrate.

926. GRAINGER, C. E. 634.723.1
The black currant in war time. How to do them well.
Fruitgrower, 1940, 89 : 217-8.

To grow black currants well it is necessary to manure heavily with farmyard manures and the best of these is pig manure at 20 loads per acre. It should be noted that if organic manure is scarce it will pay better to manure a portion of the plantation heavily and supply the rest with whatever can be got together rather than to spread the available organics thinly over the whole. The best method of application is to lay the manure in a furrow ploughed away from the bushes and then cover by ploughing back. Failing pig manure, cattle manure is good, or a 7% or higher nitrogen content wool shoddy from 1-2 tons per acre, or a composted poultry manure. The latter will be disappointing unless composted, and instructions for this are given. Inorganics are for the specialist. Stress is laid on the importance of saving all vegetable waste for humus. Hard pruning is the next essential. Directly after planting cut back to 3 buds on each shoot. It is worth while doing this the second season also, because by the extra development and increased weight of the first crop afterwards the loss of a small crop the first year is amply repaid. After the first crop the fruited wood must be entirely removed and so must all but 3 of the new basal shoots however capable of heavy cropping they may look, for if left they make the next year's growth come from the worst positions, i.e. the higher parts of the bush. After two or three seasons the bush should be drastically opened up and the older wood which always seems to accumulate, cleared out. The couplet "When in doubt cut it out" states a most useful rule

in black currant pruning. Clean weeding by frequent cultivations is advocated. The spray programme is December/January tar oil at 5% against aphids and lime-sulphur against big bud when the leaves are the size of a shilling.

927. KUZMIN, A.YA. 631.52 : 634.723 : 634.725

Successful crosses between black currants and gooseberries. [Russian.]

Proc. Lenin Acad. agric. Sci., Moscow, 1940, No. 5, pp. 3-12, bibl. 15.

Fruiting black currant \times gooseberry hybrids were obtained at the Central Genetic Laboratory, Mitchurinsk, U.S.S.R., through the use of an F_2 hybrid from a cross of two distinct species, namely *Ribes nigrum* L. and *R. Dikuscha*. The F_2 hybrid was pollinated with the pollen from the large-fruited gooseberry, "Zeleny butylochny". A hybrid thereof was again pollinated with "Zeleny butylochny" gooseberry and as a result a vigorous plant was obtained with much of the appearance of black currants.

928. NATIVIDADE, J. V. 634.75

Cultura dos morangueiros. (**Strawberry growing in Portugal.**)

Ser. Estudos. tec. Minist. Agric. Lisboa 11, 1940, pp. 136.

This is another of those attractive publications which the Portuguese agricultural authorities know so well how to produce. The bold type, the illustrations, the paper and the coloured cover, presenting a group of the most mouth-watering strawberries we have ever seen, are all first class. The cultivation of strawberries under Portuguese conditions is described in full detail and attention is paid to recent English work on degeneration and its causes. As regards latest research the publication is well up to date.

929. WALDO, G. F. 634.75

Effect of leaf removal and crown covering on the strawberry plant.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 548-52, bibl. 2.

- LONG, J. H. 634.75

The use of certain nutrient elements at the time of flower formation in the strawberry.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 553-6, bibl. 4.

- VAILE, J. E. 634.75

The influence of straw mulch on strawberries.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 567-70.

The effect of different cultural operations on the strawberry is discussed briefly in these three articles which concern work at Corvallis, Columbia, Mo., and Fayetteville, Ark., respectively.

930. POTTER, J. M. S. 634.75

Lessons from the Wisley fruit trials. II. Strawberries.

J. roy. hort. Soc., 1940, 65 : 183-6.

The procedure with strawberry plants received for trial at Wisley is to plant them in a nursery bed where observation is kept during the growing season, any weak or diseased plants being destroyed at once. They are deblossomed and only 4 runners are taken from each plant. Thus 100 good plants are propagated for transplanting into the trial bed. New varieties are then compared with 3 standard varieties, viz. Royal Sovereign, Sir Joseph Paxton and Tardive de Léopold. In this article a brief summary is given of the behaviour at Wisley of the three varieties mentioned above and of the following new varieties:—Huxley Giant, Corvallis, Aromatic, Campbell's Seedling, Redbourn, American Seedling. It is noted that at Wisley many new seedling varieties maintain satisfactory vigour and cropping over several years, only then to degenerate seriously with virus disease.

931. RODRIGUES, A. 634.8

Sobre a caracterização das espécies e híbridos do género *Vitis*. (**A new ampelographic method for classifying vine species and crosses.**) [English summary $\frac{1}{2}$ page.]

Agron. lusitana, 1939, 1 : 315-36.

The method proposed by the author for classifying *Vitis* species and hybrids is based on the shape and structure of the leaf.

932. STOUT, A. B. 634.872

Progress in breeding for seedless grapes.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 627-9, bibl. 2.

The most promising of the 208 seedless vine seedlings now available to Stout in his work in New York State are being propagated for tests in the vineyard. They and the best of their sibs, which are seeded, are being used in further selective breeding.

933. BRUNI, B. 634.8-1.523

Nuove varietà di uve da vino ottenute per incrocio. (New wine grapes obtained by crossing.)

Ital. agric., 1940, 77: 59-61.

After briefly discussing the new table grape varieties produced by Paulsen, Prosperi, Franchino and Pirovano, especially the last, the author notes the Bouschets' work on wine grapes in which the highly productive Grénache, Morrastel, Aramon and Mourvèdre were successfully crossed with Tintoria so that new varieties with more highly coloured juices became available. He gives a note on two promising crosses made at Ancona in 1932 between Trebbiano dorato and Sauvignon, which show resistance to fungi and good sugar content together with early ripening.

934. OLMO, H. P. 634.851: 575.252

Somatic mutation in the *vinifera* grape. III. The Seedless Emperor.

J. Hered., 1940, 31: 211-3, bibl. 9.

Only some 5 seedless clones are known among the 5,000 named varieties of *vinifera* grapes. The Emperor mutant described here appears to be the first authentic example of the seeded-to-seedless type of mutation. The mutant was discovered in 1928 at Visalia, Calif., as a single cane bearing seedless fruit on an otherwise normal Emperor vine. Since then 3 clonal generations of it have been propagated and all continue to produce seedless fruit. It has been named Seedless Emperor and has been patented in the U.S.A. The berries average 2.2 gm. as against 4.8 gm. in the ordinary Emperor. From 1 to 4 minute rudimentary seeds are present in about 70% of the berries, but these seeds are even smaller, .26 mg., than those found in Thompson Seedless, 1.25 mg. Since Seedless Emperor produces a larger weight of flesh per unit of seed development than other seedless varieties, it is suggested that it might be advantageous to transfer this high expression of parthenocarpy to other varieties by breeding. The genetic character of the mutation is being studied. The Emperor has a seed average of 3.1 per berry as compared with one of 1.5 for the rudimentary seeds of the "seedless" mutant.

935. POTAPENKO, YA. 634.8: 635.952.3

The northward expansion of viticulture. [Russian.]

Soc. Agric. Moscow, 1939, No. 5, pp. 119-31, bibl. 7.

Results are reported here of a biological study of vines in U.S.S.R. Notes appear on temperature and light conditions and on frost injury in winter in the more northern districts. Suggestions are offered to grape growers on selection of site, soil preparation and direction in which the rows should be arranged in vineyards in northern localities. A number of early varieties are named which are recommended for cultivation. Of the hardy stocks Amur vines and Korinka vines are particularly worth noting. To avoid total destruction of plant material by cold, one shoot on every vine should be mounded up with earth over the danger period. When unearthed, such shoots develop, however, more slowly than normal shoots.

936. TSEBRY, M. P. 634.8

Amur grapes and their utilization. [Russian, English summary 28 lines.]

Bull. Far-East Branch Acad. Sci. U.S.S.R., Vladivostok, 1938, No. 28 (1), pp. 51-86, bibl. 40.

The results of the study of *Vitis amurensis* R. conducted in the Far-Eastern bush of the U.S.S.R. for two years may be summarized as follows:—Amur grapes are genetically a species with varying botanical characters. On account of great variability of *V. amurensis* throughout the territory where it is found, the identification of all its numerous forms is quite impossible. Hence in this study grapes were divided only into three groups according to the leaf character. Descriptions are also given of other botanical characters including the male and female flowers whose

structure is considered to be the same for all forms, varieties and eco-types. The growth season of *V. amurensis* lasts 130 to 147 days. Amur grapes are hardy and some of their hybrids are known to give vigorous hardy stocks. Propagation presents no difficulty whether sexual or asexual.

937. HARMON, F. N., AND SNYDER, E. 634.8-1.541.5

The "T" bud method, an aid to grape propagation.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 663-5, bibl. 1.

Granted good technique, T budding would appear to be valuable for establishing vineyards on resistant rootstocks with the scion-stock union well above soil level.

938. BERNON, G., AND NÈGRE, E. 634.835.094

Nouvelles recherches sur les producteurs directs cultivés à l'école nationale d'agriculture de Montpellier. (Further investigations on direct producers at Montpellier.)

Ann. Éc. Agric. Montpellier, 1939, 25: 295-352.

After discussing the various points which should decide the value of a direct producer the authors consider results achieved to date. They find that certain direct producers may prove useful for the improvement of wines which have too little colour and are too little acid. The possibility of their imparting a foxy taste to the wine prohibits their use for these purposes except in relatively small proportions. Details are then given of some 30 direct producers at Montpellier and the following points are noted:—Growth and crop characters, the resistance of the plant to mildew, oidium, phylloxera, its susceptibility to coulure, its seasons of bud burst, flowering and ripening, and finally the colour of its wine and degree of acidity, these last two characters being compared with those of two viniferas, viz. Chardonnay (white) and Aramon noir (red).

939. DE FREITAS, A. G. B. 634.8-2.19: 581.144.4

Observações sobre a influência da superfície foliar no desenvolvimento da uva.

(The influence of leaf area on growth of grapes.) [English summary $\frac{1}{2}$ p.]

Agron. lusitana, 1939, 1: 401-9, bibl. 8.

The effect was tried at the Portuguese National Research Institute of reducing leaf area on the growth of grapes in the Diagalves, Muscat of Hamburg and João de Santarém vines, all of them being varieties subject to millerandage. The weight of berry increased with increase in leaf area, though after a certain point the rate of increase gradually became less. If the leaf area was excessively reduced the berries failed to ripen, becoming small and wizened. It was noted that those berries which as a rule never reach full size (millerandage) may under abnormal conditions of nutrition be liable to undergo a larger development without attaining full growth.

940. WINKLER, A. J., AND WILLIAMS, W. O. 634.8-1.547.6

The heat required to bring Tokay grapes to maturity.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 650-2, bibl. 3.

Experiments both in Europe and in California, the latter being reported here, suggest that the proper date for harvesting grapes can be determined by calculating the appropriate heat summation from the blooming period onwards. Thus for Tokay in California a summation of 2,200 day degrees from bloom to harvest with 675 day degrees for the ripening period would indicate a rating of good for the fruit. A summation of 2,260 day degrees and of 700 day degrees respectively would indicate a rating of very good.

941. KRIMPAS, B., AND DARES, T. 634.8-2.112

The relative drought resistance of vines grown in the Athens collection. [Greek, French summary.]

Hort. Res. Athens, 1940, 5: 3-6.

Vines from the Athens collection are classed as follows with regard to their drought resistance:—Very resistant: Isabelle (*V. Labrusca*), Cinsaut, Muscat of Hamburg; fairly resistant: Muscat of Alexandria, Pirovano hybrids I.P.75, I.P. Perlona and I.P. Italia, Chasselas doré, and various strains of Teleki; susceptible: Emperor, Pirovano I.P. 51, and I.P. 57 and various strains of Teleki; and lastly very susceptible: Teleki Pearl of Csaba.

942. BRANAS, J., BERNON, G., AND LEVADOUX, L. 634.8-1.8
 Une expérience de fumure de la vigne. (A vine fertilizer experiment.)
Ann. Éc. Agric. Montpellier, 1939, 25 : 267-77.

Two hundred and ten 25-year-old Aramon vines worked on Riparia gloire formed the subject of experiment. They were divided into 7 plots in which the outside plots remained untreated and the three inside ones, divided from one another by other untreated plots, received 2 kg. sulphate of potash, 2 kg. basic phosphate and 2 kg. nitrate of soda respectively in December 1937. Each plot consisted of 5 rows 1.5 m. apart. The amounts of fertilizer given were purposely excessive but it is interesting to note that judging from the 1938 harvest no effect was noticeable from the potash or phosphate given, while the effect of the nitrate was slightly favourable. This may have been due in part to the exceptionally dry winter and spring in 1937-8. Needless to say none of the results was economic. The authors discuss at considerable length the lay-out used and the methods of eliminating errors in viticultural manurial experiments.

943. ADAMANOV, F. O. 634.8-1.542.22/4
 The effect of ringing and similar operations on grape yields in Daghestan.
 [Russian.]
Proc. Daghestan agric. Inst. Makhach-Kala, 1939, No. 1, pp. 219-34.

Full accounts are here given of experiments with grapes conducted in different localities of Daghestan. The object of the study was to find what operations on vines give the highest yields of grapes. The results are tabulated and may be interpreted as follows:—Disbudding at the beginning of bloom is recommended in the Makhach-Kala district for the varieties Saperavi, Rka-Tsiteli, and Isabel, the first two varieties preferring similar treatment also in the Kizlyar district. In the Derbent district buds on Saperavi and Narma vines may be either removed at the beginning of or after flowering, the removed shoot in the latter case being 3-5 cm. In one locality of the Derbent district it was advantageous to effect disbudding on Saperavi vines at full bloom. Ringing the spurs and shoots increases the yields considerably, but has a harmful after-effect on the plant (check of growth and breaking of vines owing to strong winds). Knife edging gives the highest yields of Narma grapes under Derbent conditions, but the operation is too expensive for commercial vineyards.

944. GAVRILOVA, L. G. 634.8-1.542
 Physiological analysis of trimming the grape vine. [Russian, English summary 1 page.]
J. Inst. Bot. Kiev., 1938, No. 18-19 (26-27), pp. 97-110, bibl. 4.

Trimming experiments in Kakhetia made with Saperavi vines led to the following conclusions:—(1) Trimming the vines above the twelfth leaf from the raceme at about 10 July (which in the experimental year coincided with the period of differentiation of grapes on the cluster.—Ed.) increased the assimilative capacity of the leaves, mobilized more soluble sugars, and resulted in the greatest sweetness of the juice and the greatest average weight of 100 berries. Trimming Saperavi vines above the eighth leaf from the raceme, whether early, i.e. 10 July, or late, i.e. beginning of August, was injurious to the vines under Kakhetian conditions.

945. ZITO, F. 634.51
 La produzione e il commercio delle noci. (Walnut production in Italy for export.)
Ital. agric., 1940, 77 : 199-206.

Italy comes third in the walnut exporting countries, France being first and Rumania second. The province of Naples provided 33% of the total Italian production in 1938 and was followed by the Department of Piedmont, a poor second, Abruzzo and Molise, and others in various parts of Italy. The author, who stresses the importance of uniformity of product, urges attention to the following points:—picking not all together but as the fruit comes to its correct stage of ripeness; careful and gradual drying without exposure to very high temperature, particularly avoiding long exposure to the sun and protecting the nuts from night dews which cause the splitting open of the two halves of the nut; drying of nuts on well aired, sheltered grids; careful selection and elimination of faulty nuts including those which do not close properly, light weight nuts, broken and discoloured nuts; careful grading. He also commends a habit adopted in California of stamping the nuts.

946. ZARUBIN, A. F. 634.51-1.541

The vegetative propagation of walnuts in Kirghiz bush. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 53-7.

In Kirghizia (U.S.S.R.) wild walnuts cover an area of some 45,000 ha. A study of these natural resources was conducted at the Arslanbob branch station of the institute for dry subtropics (VNIISS). It led to the following conclusions:—Wide differences in nuts existed as regards size, flavour, and shell thickness. Per hectare yields were low. Low yields were mainly due to pests and diseases, crowded position of trees, spring frosts, and mechanical injury of the trees. In order to improve all these conditions large-scale grafting operations were carried out in the bush. Notes appear on selection and preparation of trees for budding, methods and dates for budding, budwood and wound treatment. Flute budding in mid-June to mid-July gave the best results. Cutting the bark for flute grafting before the operation resulted in a better take. Ringing stimulated the growth of the eyes and increased the percentage take of grafts made in June-July. Shield budding, though inferior to the flute method, also gave good results with fully grown and young walnut trees under Kirghiz conditions.

947. SITTON, B. G. 634.521-1.541

Pecan grafting methods and waxes.

Circ. U.S. Dep. Agric. 545, 1940, pp. 30, bibl. 38.

Various methods of bark grafting pecan were tried in order to devise a graft that would ensure that scions united with the stock at the rim of the cut, especially in topworking. Unions not complete in this way, i.e. with a stub protruding, are subject to borer attack and root rot and are also easily broken off. The most successful graft proved to be the inlay bark graft and is described as follows:—The outer bark was pared from the stock to expose the light-coloured inner bark but not the cambium; the scion was cut with a long sloping bevel 2-2½ inches long; the basal end of the scion at a point where it was ¼ inch thick was cut square across; the bevelled part of the scion was held against the pared area on the stock, the bark was cut and a strip just long enough to take the scion was removed from the stock, forming a recess with the cambial cells on the surface of the wood exposed; the bevel of the scion was placed in the recess against that surface and one or two nails were used to secure the scion to the stock. A light-coloured grafting wax was used (black was harmful in summer) composed of 5 parts rosin, 1 part beeswax, ½ part talc. This formula proved the most successful wax out of 80 tried. A beeswax which gave better results than others probably contained much propolis and was known as second run or slum gum. Of the two stock varieties used *Carya pecan* appeared to provide a higher success percentage and more rapidly growing scions than *C. aquatica*.

948. MATUBARA, S. AND MAKI, S. 634.53 : 581.162.3

Studies on pollination and fertilization with Japanese chestnut varieties.

[Japanese.]

J. hort. Ass. Japan, 1940, 11 : 102-14, bibl. 5.

No instance was found in the authors' experiments with Japanese chestnut varieties either of complete self-incompatibility or of complete cross-incompatibility. Incompatibility was much more pronounced in selfed plants than in cross-pollinated plants. Compatibility varied considerably in different combinations. Taisho-wase, Toyotama-wase, Ginyori, Yakko and Sekichu showed considerable incompatibility when crossed with Osaya as pollinator. Fruit drop in the case of unfertilized fruits continued up to 5 months after pollination. The more compatible the varieties in question, the sooner did the fruit drop come to an end. Only in the case of Kasahara-wase × Yakko was 16% pseudo-fertilization observed. In these cases only the fruit case and seed coat grew and the embryo never developed. The pollen variety did not affect the time of harvesting the crop. Cross pollination with one exception resulted in heavier fruits than selfing. In the case of Taisho-wase and Toyotama-wase very satisfactory results were achieved, both as regards compatibility and weight of fruits, by pollinating with Yakko.

949. PASCUAL, A. 634.55

Almond growing throughout the world. [1. Spain.]

Int. Rev. Agric. (Mon. Bull. agric. Sci. Pract.), Rome, 1940, 31 : 133T-48T.

In this series of articles it is proposed to deal in turn with almond growing in the following countries, placed in the order of their importance as producers of almonds:—Spain, Italy,

U.S.A., French Morocco, Portugal, Turkey, France, Algeria, Greece and Tunis. The almond grows successfully between lat. 30° and 40° N. Altitude affects it considerably and it will not normally grow above about 2,300 ft. It is very susceptible to spring frosts. It is estimated that in 1935 there were some 31 million almond trees growing in Spain, about two-thirds of which were in regular plantations. Considerable new planting is in progress, attention being paid to the planting of late-flowering varieties. Whereas vine and olive growing have gone down in favour, almond growing has to some extent taken their place. Notes are given on varieties, planting, cultivating and manuring, propagation—dormant shield buds in August–September, budding in May or cleft grafting are used—, pruning, harvest and yield—an almond should give 4½–6½ lb. in its 7th year, reaching a maximum of 26–44 lb. between the 25th and 35th years—, diseases and pests, exports, uses both as a fruit and otherwise.

950. KHANMAI, M. A., AND BROWN, W. S. 634.711-1.55
Correlations between leaf area and leaf weight and between leaf weight and fruit production of red raspberries.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 589-92, bibl. 4.
- COLBY, A. S. 634.715
The Brainerd blackberry in Central Illinois.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 593-6, bibl. 2.
- CHANDLER, F. B., AND MASON, I. C. 634.73
Pruning of the low-bush blueberry.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 609-10, bibl. 2.
- DARROW, G. M., CLARK, J. H., AND MORROW, E. B. 634.73
The inheritance of certain characters in the cultivated blueberry.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 611-6, bibl. 3.
- MERRILL, T. A., AND JOHNSTON, S. 634.73
Further observations on the pollination of the highbush blueberry.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 617-9, bibl. 1.
- STENE, A. 634.73
Some observations on blueberry nutrition based on greenhouse culture.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 620-2, bibl. 1.
- HUSFELD, B. 634.8-1.52
 Genetik und Rebenzüchtung. (Genetics and the raising of vines.)
Agron. lusitana, 1939, 1 : 200-35, bibl. 36.
- LEVADOUX, L. 634.8
 Contribution à l'étude du vignoble auvergnat. (The vineyards of Auvergne.)
Ann. Éc. Agric. Montpellier, 1939, 25 : 353-436, bibl. 88.
- FINCH, A. H., AND VAN HORN, C. W. 634.521
Studies on the evaluation of factors influencing oil content and filling of pecan nuts.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 481-3, bibl. 1.
- LUTZ, H., AND HARDY, M. B. 634.521
The effect of foliar conditions on the photosynthetic activity of pecan leaves.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 484-8, bibl. 5.
- HARDY, M. B., LUTZ, H., AND MERRILL, S. 634.521
A preliminary report of pecan leaf scorch studies.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 489-92, bibl. 1.
- FINCH, A. H., AND VAN HORN, C. W. 634.521
Notes on the relation of warm winter temperatures to blossoming and nut setting of the pecan.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 493-7, bibl. 1.
- DODGE, F. N. 634.521
Some blossoming relationships found in a study of the dichogamy of pecan varieties.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 503-8, bibl. 5.

- REED, C. A. 634.53
Recognized and potential varieties of two oriental species of chestnut.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 498-502.
- McKAY, J. W. 634.53
Male sterility in *Castanea*.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 509-10, bibl. 4.
- BROOKS, R. M. 634.551
A growth study of the almond fruit.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 193-7, bibl. 5.
 A 3-year study.

PLANT PROTECTION OF DECIDUOUS FRUITS.

951. HOPKINS, J. C. F., AND BACON, A. L. 634.11-2.1+2.3/4
Diseases of fruit, flowers and vegetables in S. Rhodesia. 1. Common diseases of apples and their control.
 Reprinted from *Rhod. agric. J. as Bull. Minist. Agric. S. Rhod. 1152, 1940, pp. 18.*
952. WORMALD, H., AND HARRIS, R. V. 632.1/8 : 634.1/7 + 633.79
Notes on plant diseases in 1939.
A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 58-62.
953. VERNER, L. 634.23-2.19
The nature of cracking in sweet cherries and possible solutions of this problem.
Proc. 35th annu. Meeting Washington St. hort. Ass. 1939, Wenatchee, Wash., 1940, pp. 54-7.

Cracking of cherries is caused by absorption of water through the skin and usually occurs during periods of rain. Evidence is produced to prove this. The most vulnerable point is the apex of the cherry where the sugar concentration is highest. Varietal differences in susceptibility to cracking are determined by permeability of the fruit skin to water, and differences in the capacity of the skin to stretch without rupturing. There are also resistant cherries on almost any tree and the fact that this is so suggests the possibility that all might be made so. A spray of hydrated lime, 12 lb. to 100 gall. water, reduces permeability to a considerable extent, i.e. retards and is therefore useful in short rains but not in prolonged ones. The residues are objectionable and have to be removed by a spray containing $\frac{1}{2}\%$ acetic acid followed by a rinsing spray. Owing to the close correlation between degree of maturity and liability to crack the ripest trees should be harvested first; a single day's delay in picking sufficiently mature fruit may mean the difference between a good profit and a total loss. The most satisfactory solution lies in the breeding of resistant commercial types of which the Idaho Experiment Station already has several promising hybrids.

954. MACARTHUR, M. 664.85.11 : 632.19
Histology of some physiological disorders of the apple fruit.
Canad. J. Res., 1940, 18, Sec. C, pp. 26-34, bibl. 12.

The histological similarities and differences between the boron-amenable disorders, internal cork, corky core, and drought spot, and the non-boron-amenable disorder, bitter pit, are presented. Blotchy pit is discussed as a border-line type, since one end of a graded series is similar to internal cork and the other is indistinguishable from bitter pit. On the basis of histology water core is not placed in either of the two groups. Starch retention, in localized or diffuse necrotic areas, is common to both groups of disorders. External papillations occur on the walls of cells in close proximity to the lesions. Abnormal meristematic activities coexist with boron deficiency. These are (1) a cork cambium partially or completely walling off a lesion, (2) massed linear cells, heavily papillated, and (3) reactivated individual cells or groups of

cells. All three types of abnormal cells may be present in internal cork and drought spot, but no cork cambium occurs in corky core. [Author's abstract.]

955. BURRELL, A. B. 634.11-2.19 : 546.27

The boron deficiency disease of apple.

Ext. Bull. Cornell agric. Exp. Stat. 428, 1940, pp. 28.

Symptoms of boron deficiency in apple are internal or external lesions in the fruit and dieback and rosette in the vegetative parts. Often the symptoms appear in the fruit only. If the foliage is affected the fruit is always spoilt also. The disease is more in evidence in dry years possibly because there is a reduction in the availability of boron. Although there are many exceptions boron deficiency is most frequent on shallow or very porous soils and on neutral or alkaline soils. Trees owing their increased vigour to nitrogen manuring or soil cultivation are more affected than nitrogen-starved trees. Soil treatment with borax at almost any time except in winter was beneficial. The amount per tree ranges from 2 oz. for trees 4-6 years old to 12-16 oz. for trees over 25 years. Borax is a bad mixer with dilutants but although the amounts per tree are often small a careful workman should be able to make an even distribution without dilution. Excess boron application may injure the foliage. The distinctive symptom of boron leaf injury is the disappearance of the green colour along the midrib and larger lateral veins.

956. WALLACE, T., AND JONES, J. O. 634.11-2.19 : 546.27

Boron in relation to bitter pit in apples.

J. Pomol., 1940, 18 : 161-76, bibl. 18.

Investigations described here were carried out in 1935 and 1936, primarily to determine whether boron is at all related to the incidence of bitter pit in English apples. The trees from which material was taken were growing in the Wisbech area, Essex, Kent, Herefordshire and Cheshire and the main variety was Bramley's Seedling. It was shown both by the boron status of the fruits and leaves and by injection treatments with boric acid that the pitting troubles were not concerned with boron.

957. WALLACE, T., AND JONES, J. O. 643.11-2.19

Pot experiments on bitter pit of apples.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 79-84, bibl. 2.

Injection experiments, using salts of various major and minor elements and citric acid, have been carried out on apple trees, variety Bramley's Seedling, growing in a compost in pots, to determine the effects of the various elements and compounds on the incidence of bitter pit. Bitter pit was severe under all treatments and it is concluded that the elements and compounds concerned are ineffective in controlling the trouble. Of the elements used only cobalt and nickel caused appreciable damage to the trees. Field tests have also shown the ineffectiveness of boric acid and iron citrate in controlling bitter pit of apples and cork in pears. [Authors' summary.]

958. MEIER, K. 546.27 : 634.11-2.19

Über stippige und krüppelige Früchte sowie andere krankhafte Veränderungen an solchen und an Trieben von Obstbäumen und ihre Ursachen. (A nutrient deficiency study.)

Schweiz. Z. Obst-u. Weinb., 1940, 49 : 79-92, bibl. 6.

From Switzerland the incidence is reported of internal cork of apples and similar diseases of pears, apricots and cherries. Boron applied in conjunction with normal fertilizers (N, P and K) was found to be a highly successful method for combating internal cork of apples.

959. HEINICKE, A. J., BOYNTON, D., AND REUTHER, W. 632.181.1 : 634.11

Cork experimentally produced on Northern Spy apples.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 47-52, bibl. 6.

The experiment on a 27-year-old Northern Spy apple tree described here indicates that the inability of apple roots to function properly owing to unfavourable soil conditions induced by flooding results among other things in an abnormality of the fruit which cannot be distinguished from the cork due to boron deficiency.

960. KIDSON, E. B., ASKEW, H. O., AND CHITTENDEN, E. 634.11-2.19-1.811.6
Magnesium deficiency of apples in the Nelson district of New Zealand.
J. Pomol., 1940, 18 : 119-34, bibl. 8.

Premature leaf drop in apple trees in the Nelson district, N.Z., was identified as a magnesium deficiency symptom. The most characteristic feature is brown blotching of leaves, particularly between the veins, followed by defoliation, the older leaves of new leader growth being invariably affected. Injection of magnesium sulphate into branches of affected trees prevented the symptoms. A good correlation was established between low magnesium content of leaves and leaf blotching. The phenomenon was most severe where potash had been given liberally and leaf analyses showed high potash figures in association with low magnesium content. It would appear that liberal potassic manuring has established an unfavourable available K to available Mg ratio in the soil.

961. WALLACE, T. 634.1/7-2.19-1.811.6
Chemical investigations relating to magnesium deficiency of fruit trees.
J. Pomol., 1940, 18 : 145-60, bibl. 3.

1. Chemical investigations are reported on foliage and soil samples obtained from 10 centres where symptoms of magnesium deficiency were shown in 1939 by various fruit plants, mainly apple trees, but also black currant and gooseberry bushes and plum trees. [Symptoms : defoliation, central blotching, marginal and interveinal scorching.] 2. The data for the foliage show that in every case the symptoms of magnesium deficiency were accompanied by low magnesium status in the leaves. 3. The relations between the amounts of CaO, MgO and K₂O in healthy leaves and in leaves deficient in each of these substances are illustrated ; and it is shown for CaO and K₂O how one of these may dominate in leaves where the other is deficient. 4. At one centre the amount of MgO in the dry matter of the leaves did not vary appreciably where the level of K₂O was varied between wide limits. 5. Two groups of cases are distinguished when MgO is deficient, the first when CaO is low and the second when this base is high. The importance of this grouping in evolving a practical remedy for MgO deficiency is indicated. 6. It is shown that a time lag may be expected between the time of applying lime and magnesium sulphate dressings before the levels of CaO and MgO become satisfactory in the foliage of apple trees. 7. The possible importance of magnesium deficiency in cases of abnormal susceptibility to spray injury is discussed. [Experiments at Long Ashton have shown that deficiencies of N, P, K, Ca and Mg increase the susceptibility of gooseberries in sand culture to injury from lime-sulphur spray. Wallace himself has also found that on field plots trees seriously deficient in N or K have been excessively damaged by sprays. Since Mg-deficient trees lose their foliage very easily and portions of their leaves become damaged and soft he considers it most probable that their foliage will be highly susceptible to spray damage.] [Annotated author's summary.]

962. HILL, H., AND JOHNSTON, F. B. 634.11-2.19-1.811.6
Magnesium deficiency of apple trees in sand culture and in commercial orchards.
Sci. Agric., 1940, 20 : 516-25, bibl. 16, being *Contr. Div. Hort. Dep. Agric. Ottawa* 557.

Some results obtained by recent workers on magnesium deficiency in various crop plants are briefly noted. In the present experiments the effects of magnesium deficiency on Melba, Fameuse and McIntosh apples grown in sand culture are described. Deficiency symptoms did not appear till the 4th year when shoot growth of all three was only 50% of that of the controls and in July large patches of dead tissue began to appear in the centre or round the margin of basal, older leaves of numerous shoots. Growth was vigorous early in the fifth season, but the leaf symptoms reappeared in July and were severe by early August. Some differences in symptoms between varieties are mentioned and illustrated. Symptoms of magnesium deficiency in commercial orchards were not easy to trace until a marked disorder, bearing all the signs of magnesium deficiency and especially severe on Melba, occurred in a large apple-growing province of Quebec in 1938. Local soil conditions associated with magnesium deficiency are reported. Leaves from the affected orchards compared with normal leaves had a very low magnesium content, a normal phosphorus and calcium content and a somewhat higher potassium content. Soil treatments with magnesium sulphate, sulphate of potash, magnesia and dolomite limestone

failed to increase the magnesium content of the leaf or to prevent the disorder occurring in the year of application. The possibility of magnesium deficiency increasing the possible susceptibility to spray damage is noted.

963. EREMEEV, G. N. 632.112 : 634.1/7
Drought resistance of certain fruits and soft fruits. [Russian, English summary
 44 lines.]

Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 245-57, bibl. 14.

Accounts of experiments with almond, peach, olive, pear, apple and other top fruits and soft fruits at the Nikita Botanical Garden. The object of the study was to improve the methods of diagnosis of drought resistance of some varieties of fruits. The results may be summed up as follows:—(1) the degree of resistance to wilting of leaves and shoots is characteristic of the degree of resistance of a variety; (2) the degree of resistance of leaves is manifested in their ability to restore turgidity after the same period of wilting; (3) the different degrees of resistance of leaves are due to their varied ability to retain their water supplies at wilting. Such variation was observed between the leaves of the same varieties and even of the same trees; (4) weak response of stomata to wilting is one of the reasons for poor water retaining capacity of some leaves at wilting; (5) the closing of the stomata in the wilting cut leaves or the turgescient leaves left on the plants lowered the rate of transpiration; (6) leaves that were resistant on wilting plants also retained more water in their tissues when cut than non-resistant leaves; (7) resistant leaves of any given variety or even of a single plant, retained in their tissues relatively higher quantities of water than drought-susceptible leaves, and also manifested a higher rate of respiration; (8) in early stages of wilting the rate of respiration of leaves rose, but after the loss of 20 to 30% (dry weight) of water the rate of respiration began to fall, this fall being particularly sharp in the case of drought-susceptible leaves; (9) leaves similarly placed on plants as regards position on shoots, had similar anatomical and physiological properties determining drought resistance.

964. STUART, N. W. 634.11-2.111
Comparative cold hardiness of scion roots from fifty apple varieties.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 330-4, bibl. 10.

Results are tabulated showing the relative hardiness of the scion roots of 50 American apple varieties as determined by electrical conductivity of exosmosed electrolytes after freezing at 20° F. In addition six of them were also frozen at 17.5° F.

965. SCOTT, D. H., AND CULLINAN, F. P. 634.25-2.111
Peach variety resistance to cold injury at blossom time.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 209-14, bibl. 3.

Observations were made in 1938 and 1939 on some 150 varieties of young peach at Beltsville, Md, with regard to their frost resistance at blossom time. Although the final hard frosts in both years came about the same time and were of similar severity, there was much less damage to the harder varieties in 1939. This was probably due to the hardening off of the fruit buds as the result of uniformly cold weather between the early high temperatures and the time of the last severe frost. Some varieties behaved very differently in the two years. On the whole some of the Hale types seemed to possess greater blossom frost resistance than many other varieties. The Crawford group and Hiley appeared to be particularly susceptible, while Veteran, Mikado and Viceroy appeared outstandingly frost tolerant.

966. GESLIN, H. 632.111 : 634.1/7
 La lutte contre les gelées et les seuils de résistance des principales cultures
 fruitières. (**Frost protection measures and the limits of resistance in the
 chief fruit growing districts of France.**)

Ann. Épiphyt. Phytogén., 1939, 5 : 7-16, bibl. 13.

A discussion of the whole problem of spring frost damage in fruit trees with notes and observations made at Versailles in April 1938. The conclusion is reached that susceptibility to cold increases regularly from the unopened flower bud to the young fruit just set. The effect of stage of growth would appear to be much more important than that of variety. Thus a late flowering variety

will always have more chance of escape than an early flowering one. Hence the search for any methods able to retard the start of growth is important. The above statements do not preclude the fact that some varieties are actually more resistant than others, either because of a particular constitution of the tissues or of the actual nature of their cell sap or of the relative position of the sexual organs in the flower. With the exception of the vine and the walnut it may be said of the ordinary deciduous fruits studied the limit of resistance appears on the average to be lower than -6°C . in unopened fruit buds of 3-4 mm. in diameter, the temperature being taken at the level of the organs studied (thermometer exposed to the open air in a horizontal position). Just before flowering the critical temperature rises to about -4°C . to -4.5°C . It then falls to -2.5°C . to -3.5°C . for flowers in blossom and is about -2.5°C . when fruits have just set. The degree of susceptibility varies with species and is higher in wet than in dry weather. The susceptibility in one and the same variety varies, presumably according to differences in nutritional conditions.

967. OSTERWALDER, A. 632.111 : 634.8
 Prüfung von Massnahmen gegen Frühjahrsfröste an Reben. (**Control measures
 against spring frost-injury on vines.**)
Schweiz. Z. Obst- u. Weinb., 1940, 49 : 179-88.

Swiss experiments have shown that spring frost injury to vines cannot be controlled by spraying the vines with water, salted water and milk of lime or by dusting with lime. Guarding the vines against frost with the aid of covers, particularly straw covers, showed promise. The covers must give protection against rain, fog, and dew, must be tight on top and yet not allow the temperature inside the cover to rise to such an extent as to hasten shooting of young tender buds.

968. SCHOONOVER, W. R. 634.11-2.111
The use of thermometers in orchard heating.
Publ. Ext. Serv. U.S. Dep. Agric., 1940 ?, pp. 4.

The success of orchard heating depends on the use of accurate thermometers properly exposed and properly read. Suitable types of thermometer are described and directions are given on their use in the orchard. A table is attached giving temperatures as registered by properly sheltered thermometers which may be endured for 30 minutes or less by apples, peaches, cherries, pears, plums, apricots, prunes, almonds and grapes in various stages of development, namely when buds are closed but show colour, full bloom and in the small green fruits stage.

969. GRAINGER, J. 634.1/7 : 581.144.5 : 632.111
**The internal temperatures of fruit tree buds. III. Trials with humidified heat
 for the control of frost damage.**
Ann. appl. Biol., 1940, 27 : 1-4, bibl. 1.

Previous investigations were reported *ibidem* 1936, 23 : 1-10 ; *H.A.*, 6 : 270 and *ibidem* 1939, 26 : 1-13 ; *H.A.*, 9 : 1165. An account is here given of the distribution of heat and relative humidity from methods of orchard heating, namely from smudging fires, from flame-type oil-burning heaters and from a new method. In the last newspapers were pulped in water, squeezed into balls by hand, dried at 65°C . and immersed in oil ; eight balls absorbed nearly $1\frac{1}{2}$ pints of oil. Ignited in groups of 6 or 8 the heating effect was very similar to that of a flame type heater. Adequate humidification was finally obtained by placing a large forkful of thoroughly soaked, long garden refuse such as grass, over a heap of 8 burning balls. Such an arrangement burns without attention for 2 hours, heats the air and maintains or increases relative humidity. The internal temperature of the bud is not lowered as is the case with the flaming heater and the method helps to control frost at its source by diminishing radiation of heat from the earth to an open sky. The expenditure of fuel is about one-third that of flame type heaters. Lateral distribution of warmth from orchard heaters is not great and suggestions are made for the alternate distribution of fruit trees and heaters on a slope so that advantage may be taken of the katabatic wind which occurs during a radiation frost to direct the heated air towards the trees.

970. MATHIESEN, A. 634 : 632.111
 Külmakahjustustest puudel ja põõsastel 1939/1940. a. talvel. (**Frost damage to trees and bushes in the winter of 1939/40 in Estonia.**) [Estonian, English summary 1 page.]
Esthon. J. agric. Sci. Tartu, 1940, No. 5, pp. 297-314 and No. 6, pp. 460-2 and 475-6.

The winter of 1939/40 in Estonia was exceptionally severe. Considerable damage was caused to trees and shrubs including conifers. Notes are given of the comparative damage suffered by different species. Instructions are contained for the treatment of frost-damaged trees, the essential point being the removal of injured limbs before the beginning of sap-flow.

971. KIVILAAN, A. 634.1/2 : 632.111
 Külmakahjustustest ja nende võimalikkude tagajärgede pehmemdamise võimalustest viljapuuaiades. (**Frost damage to Estonian orchards and its control.**) [Estonian, German summary 39 lines.]
Esthon. J. agric. Sci. Tartu, 1940, No. 5, pp. 315-9 and No. 6, p. 476.

Investigations conducted in the pomological garden of the Tartu Experiment Station, Estonia, showed that following the severe winter of 1939/40 all pear, plum and cherry trees were destroyed irrespective of variety or age. Of some 150 apple varieties nearly three-quarters were completely destroyed or suffered severe injury, the remaining one-quarter showing different degrees of hardiness. No injury occurred to Hyslop, *Malus baccata praecox* and *Malus prunifolia*. The injury was slight on Antonovka, Borovinka, Yakhontovoe, Korichnevoe, Litauer Zuckerapfel, Golden Livland Reinette, *Malus silvestris*, Säfstaholm and Weisser Klarapfel. Of the Mitchurin varieties only Arkad Zimny, Bessemianka, Kitaika Zolotistaya and Saffron Pippin were relatively hardy under Tartu conditions. Soft fruits showed little, if any, injury.

972. HERBERT, D. A. 632.8
Plant viruses in Queensland. I.
Pap. Dep. Biol. Queensland Univ., 1939, Vol. 1, No. 11, pp. 4, bibl. 4, 1s.

The following plant viruses are here dealt with briefly:—Galinsoga Virus 1, Cucumis Virus 1, Dahlia Virus 1 and Lycopersicum Virus 3.

973. POTTER, J. M. S. 634.75-2.8
Lessons from the Wisley fruit trials. III. Yellow-edge of strawberries.
J. roy. hort. Soc., 1940, 65 : 256-60.

This article describes the attempts being made at Wisley to solve the problem of obtaining stocks of strawberries free from virus diseases and maintaining them in that condition. The symptoms of the two diseases, yellow-edge and crinkle, are briefly recapitulated, and the fact that there is a gradation from susceptible varieties showing clear symptoms to resistant ones, which carry the disease without showing symptoms, is stressed. The varieties grown at Wisley were classified entirely by noting the symptoms exhibited when they became infected with yellow-edge. The two groups were then grown isolated from one another to prevent spread of disease from the carrier to the susceptible varieties. Vigorous plants were chosen for propagation, being restricted to 5 runners, which were planted out in August to establish a new plantation for the following year, only thus treating the plants as annuals. Spraying with nicotine to eliminate the aphid vector was carried out once or twice during the season but no figures of the percentage kill are given. For satisfactory control of the spread of virus, control of aphides must approach 100%. A strong criticism of this method of growing strawberries is that there is no guarantee that the vigorous plants chosen for propagation are in fact virus-free, especially if the variety is of the carrier or intermediate type, and symptoms may not show even on the susceptible varieties until late August, September or October, by which time the new runners will have been planted out. Moreover, if virus-free stocks of susceptible varieties are once obtained by cumulative selection or better still by direct infection tests, it should be possible to maintain healthy plantations for much longer than one year provided they are adequately isolated from varieties of the carrier type. It is clearly only on such an assumption of reasonable length of plantation life that the system of virus disease control by plant selection, varietal segregation and vector

control has any commercial application. This is realized by the writer who limits the recommendation of his system of annual planting to small private garden owners and concludes that "the cost of such a proceeding as that adopted at Wisley would prohibit it being put into practice on a commercial scale and it is to be regretted that nothing has so far been found which would assist the professional grower to grow strawberries free from virus disease".

R.V.H. and M.E.K.

974. HARRIS, R. V., AND KING, M. E. 634.75-2.8

Review of research on strawberry virus diseases 1932-1939.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 66-8, bibl. 4.

The viruses discussed are yellow-edge and crinkle. As regards the former, work has been carried out to determine symptom expression in different varieties, plants and seasons. The susceptibility of different *Fragaria* species has been examined. In crinkle the significance and interrelation of the mild and severe forms has been studied. It may be noted that mechanical transmission of yellow leaf and crinkle to species of *Fragaria* and to the cultivated strawberry has so far failed. A future programme for work at East Malling is sketched out.

975. CHEAL, W. F. 634.75-2.8

A difficult strawberry problem in the Isle of Ely.

Gdnrs' Chron., 1940, 107: 107-8.

In the Isle of Ely virus-free strawberry plants obtained from East Malling Research Station became badly infected with yellow-edge in 3 out of 4 localities within 10 months from planting. All these localities except the uninfected site were within $\frac{1}{4}$ mile of degenerating infected plantations and in each of these experimental plots except the uninfected plot aphides of various soils had established themselves. One plot was treated with nicotine dust and a 94% control of aphides obtained, but this did not reduce the percentage of infection. Many growers are unaware of the infectious nature of the disease, others who are aware do nothing to prevent its spread. In Royal Sovereign the symptoms are usually apparent but other varieties in the neighbourhood are probably carrying the disease in a masked form. This will spread and possibly, if certain obscure factors become suitable, the infectious ones will themselves suddenly succumb. Planting expensive disease-free stocks in established strawberry growing areas is not a wise proceeding.

976. MASSEE, A. M., AND GREENSLADE, R. M. 634.75-2.8 + 2.753

Dipping of strawberry runners before planting.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 73-4.

The practice of dipping strawberry runners in a solution of soft soap 8 lb. per 100 gallons and nicotine 8 oz. is a routine one at the East Malling Research Station and on many commercial farms to eliminate any chance of viruses being spread by the strawberry aphid, *Capitophorus fragariae* Theo. Reports of damage have been received and the present trials were made to determine whether the soft soap was responsible. Normal, half normal, and double amounts of soap and the normal amount of nicotine were used in the trials and both home-made soap and soft soap. Although the plants treated with 12 lb. and 16 lb. per 100 gallons showed the edge of the young leaves to be scorched on one or two plants 2 weeks after dipping, 10 days later all plants had grown considerably and no difference could be seen between any of the treatments. The injury, therefore, was certainly not permanent. The practice of dipping, using the solutions given above, i.e. 8 lb. per 100 gallons, should, therefore, be continued. Plunge the whole of the plants into the solution and remove as soon as they are completely wetted. If the runners are tied in bundles the strings should be cut so that the centre plants may be thoroughly wetted. On removal the surface moisture is allowed to evaporate before planting.

977. MARSH, R. W., AND SWARBRICK, T. 634.22-1.541.11 : 632.314

Notes on the incidence of plum bacterial canker in relation to methods of propagation.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 85-7, bibl. 3.

There is a tendency to substitute Victoria and Giant Prune for the Yellow Egg plum. Both the former are, however, very susceptible to bacterial canker and Victoria to silver leaf and it is

essential to find a rootstock on which these varieties will flourish and not show great susceptibility to these troubles. Observations on scattered units in a commercial fruit farm give the following indications:—In low-worked trees, Kentish Bush is a satisfactory rootstock for both Victoria and Giant Prune, and Giant Prune trees on this stock show marked resistance to bacterial canker. Giant Prune top-worked on to young Pershore trees makes satisfactory growth, but top-working of Victoria on to Pershore gives a tree lacking in vigour. [From authors' summary.]

978. SIEGLER, E. A., and BOWMAN, J. J. 634.25-2.314
Crown gall of peach in the nursery.

Phytopathology, 1940, **30** : 417-26, bibl. 4.

Most of the galls of crown gall of peach (*Phytophthora tumefaciens*) in the nursery are at or near the root-stem junction at the crown of the root system. The disease is very prevalent where it is the practice to plant the seed after it has sprouted. It is generally prevalent in relatively alkaline soils. These experiments furnish additional evidence that more infection occurs following the artificial inoculation of alkaline than of acid soils. As acid a condition as is compatible with satisfactory growth would appear, therefore, to be a safeguard. Moreover, the treatment of the hard, uncracked pits with a strong water suspension of calomel (4 oz. to 1 gallon) at planting time is worth a trial, since in one season's trials calomel treated pits showed only 6% infection compared with 71% infection on 4 control, untreated plots.

979. PIDOPLICHKA, M. M. 632.4
A list of fungi attacking cultivated plants. [Ukrainian.]

Ukrainian Academy of Sciences, Kiev, 1938, pp. 597, bibl. 61, 15 roubles.

Practically all known parasitic and semi-parasitic fungi of agricultural, medicinal, industrial and fruit and vegetable garden plants as well as of ornamentals are said to be included in this list. In addition to these the more widely distributed saprophytic species of fungi are listed that are frequently found in conjunction with the parasitic species. The alphabetical list attached contains some 2,200 species of fungi.

980. MOORE, M. H. 632.42 : 634.11
A brief review of research work at East Malling on the control of apple scab.
A. R. East Malling Res. Stat. for 1939, **A23**, 1940, pp. 75-6.

Adequate control of apple scab, *Venturia inaequalis*, can now be achieved by selection of the right strength of lime-sulphur or bordeaux and application at the correct time. Lime-sulphur is still the standard fungicide for the purpose despite the danger of spray damage, because other sprays while showing greater all-round safety have proved too expensive to use at the concentrations necessary. It is, moreover, more effective in keeping red spider and apple mildew in check. Attempts to achieve greater safety by the addition to the spray of such substances as ferrous sulphate and cottonseed oil have not been entirely satisfactory. The main problem remains spray damage and the extent of this is now known to be closely related to such factors as locality, weather conditions, soil and cultural and manurial practices. Experiments are therefore in progress in which the influence of cover cropping, of soil moisture content and of manuring on the susceptibility of the host plant to disease and spray damage is being studied.

981. CASS-SMITH, W. P. 634.11-2.42
Black-spot or scab of apples.
J. Agric. W. Aust., 1940, **17** : 56-67, bibl. 4.

An account is given of a recent severe outbreak of apple scab (*Venturia inaequalis*) in Western Australia and of the energetic measures taken to deal with it. A note of previous outbreaks is given which from 1930 to 1939 numbered 5; of these only two were to be attributed to infection from a common source. The life history and symptoms of the disease are described and illustrated.

982. HADORN, CH. 632.42 : 634.11 + 634.13
Achtung! Schorfgefahr! (Notes on apple and pear scab in Switzerland.)
Schweiz. Z. Obst- u. Weinb., 1940, **49** : 169-76.

The habits of the scab fungi (*Venturia inaequalis* and *V. pirina*) are described, conditions favouring infection examined, and different types of scab (early, late and storage) are discussed. Control measures are dealt with elsewhere.

983. HOLZ, W. 632.42 : 634.11 + 634.13
 Fortschritte in der Bekämpfung von *Fusicladium dendriticum* (Wallr.) Fckl.
 mit chemischen Mitteln in den Jahren 1936-1938. (The latest progress in the
 control of *Venturia inaequalis* and *V. pirina*.)
Forschungsdienst, 1940, 9 : 278-88, bibl. 48.

All the more recent research on scab control is here reviewed. The results of work conducted in Germany may be summarized briefly as follows :—Pre-blossom spraying in conjunction with post-blossom spraying with the common fungicides gives the best results. It should be done before the principal flight of the spores begins. In this connexion two methods that have been worked out by the author and will shortly be published of pre-determining the flights of ascospores will prove useful. The chief objections to early spring bordeaux treatment in Germany are tree injury (presumably foliage), poor control and the scarcity of copper. Spraying at full bloom with copper-lime, lime-sulphur and Nosprait after initial success proved to be a failure. A new proprietary fungicide, Pomasol (OC 72), which is a sulphur preparation (without arsenic) and is not dangerous to bees, proved unsatisfactory. It is hoped to obtain useful fungicides non-injurious to plants by extracting the juice of plants belonging to the *Solanaceae*, *Ranunculaceae* and *Compositae*. Decoctions of *Solanum nigrum* and *Solanum Dulcamara* gave promising results in laboratory trials. Little work has been done to control the fungus in its winter stage. In Germany it is limited to laboratory trials with nitro-lime on freshly falling and rotting leaves ; in these all the perithecia of the fungus were killed. This method promises some scope as an additional scab control measure.

984. STATENS FORSØGSVIRKSOMHED I PLANTEKULTUR. 632.42 : 634.11
 Forsøg med Svovlpulver til Aebletræer. (The use of powdered sulphur on
 apple trees.)
Medd. Forsøgs. Plante. Kbh. 280, 1939, pp. 4.

Experiments conducted for some time in Denmark indicated the probable efficacy of some sulphur dust preparations (Dana Dust, Olite and Kolodust) for apple scab treatment.

985. WORMALD, H. 634.11-2.8
 The angular leaf spot of apple trees.

A. R. East Mallng Res. Stat. for 1939, A23, 1940, pp. 63-6, bibl. 6.
 The occurrence of angular leaf spot of apples was recorded in 1939 in 6 localities in this country. In some cases a *Phyllosticta* and in one at least a *Cladosporium* was found present in the affected area. One of the *Phyllosticta* isolated was found to differ from that found by Wenzl in 1936. In an appendix it is noted that recent evidence pointed to the primary cause of certain cases of angular leaf spots being the frog-hopper *Cercopis sanguinea* Geoff.

986. HARRIS, R. V., BEAKBANE, A. B., AND MOORE, M. H. 632.48 : 634.714
 A review of research on cane spot of loganberry and phenomenal berry.
A. R. East Mallng Res. Stat. for 1939, A23, 1940, pp. 68-9.

The authors summarize the results or progress in the last case of 4 lots of experiments on the control of *Elsinoë veneta* on loganberry and phenomenal berry. *Expt. 1.*—*Spraying*. Bordeaux or lime-sulphur spray at the pre-blossom (May) stage followed by a proprietary copper spray in late June was satisfactory. Derris was added for beetle control. *Expt. 2.*—*Methods of training*. A considerable degree of control was shown to be possible by appropriate training. *Expt. 3.*—*Combined training + spraying*. Infection was found to be least on plants trained by the fan method and most on those trained at 6 ft. apart on double wires. Spraying once pre-blossom, once at the beetle stage and once after cropping, was found to be best. *Expt. 4.*—*Combined training + spraying*. In these experiments, which are still in progress, unsprayed controls have been introduced. These were absent in experiment 3 above.

987. HICKMAN, C. J. 634.75-2.411
 The red core root disease of the strawberry caused by *Phytophthora*
Fragariae n.sp.
J. Potomol., 1940, 18 : 89-118, bibl. 27.

This important disease has been the subject of considerable study in recent years, particularly in the Clyde Valley, intensive strawberry growing area of Scotland, where its rapidly spreading

attack has been responsible for immense losses. The appearance in July 1935 of a sharply localized outbreak at Westerham Hill, Kent, was therefore a matter for grave concern, and at the same time provided an ideal subject for an intensive study of the disease from both the etiological and ecological aspects. Such an investigation (unfortunately brought to a premature conclusion on the outbreak of war in 1939) was started in 1937 with funds allocated by the Agricultural Research Council and under the direction of the Mycologist to the Ministry of Agriculture and Fisheries, and forms the subject of the communication under review.

The salient conclusions from the point of view of strawberry growers are briefly as follows:—The prime cause of the disease is finally and conclusively proved to be a fungus, a species of *Phytophthora* differing from all species hitherto described, to which the name *Phytophthora Fragariae* is assigned. This fungus was successfully isolated in pure culture and its parasitism of strawberry plants proved by direct soil inoculations. Attempts to get the fungus to attack living plant tissues other than those of the strawberry have so far failed.

The fungus invades the roots from the soil from autumn to spring, and this is followed by their decay owing to the action of a wide range of soil fungi, and leads to the gradual dwarfing, desiccation and sometimes wilting of the overground parts of the plant and ultimately to its death. The fungus passes back from the point of entry at the rootlet tip causing that characteristic reddening of the central vascular cylinder of the roots from which the name of the disease is derived. The disease attack and its intensity were found to be related to the drainage capacity of the soil, being most severe in those parts of the field where drainage was impeded. In certain instances there was evidence of parasitism in well-drained soil but here the disease was comparatively mild and did not spread to any discernible extent. Some evidence was obtained that the disease is encouraged by soils giving an acid reaction. On the early data from a varietal infection trial, varieties are tentatively grouped as very susceptible to the disease, e.g. Huxley, or as showing considerable resistance, e.g. Pillnitz. Other varieties including Royal Sovereign are classed as intermediate between these two groups. Promising seedlings bred for resistance by the Scottish workers remained free from attack at Westerham.

From these early results the following conclusions on the control of the disease are tentatively drawn. The total eradication of the parasite from the soil either by disinfection or crop rotation methods, is regarded as "practically a hopeless task" owing to the resistant and persistent nature of the causal fungus. The possibility of checking the rapidity of local spread and of lessening the degree of attack by the amelioration of soil conditions is envisaged but considerable experimental work is thought to be necessary before specific measures can be formulated. Final emphasis is placed on the promising field of plant breeding, aiming at the production of varieties combining desirable fruiting qualities with high resistance to the disease, and the considerable early successes of the workers in Scotland are pointed out in this respect. Pending introduction of such varieties, the growing of the more resistant of existing varieties, Pillnitz, Early Cambridge, and Oberschlesien on land on which other varieties succumb to the disease, is suggested.

R.V.H.

988. GERRITSEN, J. D. 632.47 : 634.1/2
Onderzoekingen op het gebied van de loodglansziekte. (Silver leaf disease.)
Fruiteelt, 1940, 30 : 77-85.

Silver-leaf disease, especially of plums, appears to be spreading in Holland but many growers are not generally familiar with it. In this lecture delivered at Utrecht the history, cause and methods of combating the disease are dealt with, the whole, as freely acknowledged, being largely based upon the work of Brooks. In view of the difficulties of effective control the future seems to be largely in the selection or production of varieties of low susceptibility.

989. GIMINGHAM, C. T. 632.9
Some recent contributions by English workers to the development of methods
of insect control.*
Ann. appl. Biol., 1940, 27 : 161-75, bibl. 112.

This article is of special interest to fruitgrowers. It is moreover neither popular blather nor scientific jargon but a very clear, interesting and thoroughly well documented account of recent

* Presidential address, annual general meeting, Association of Applied Biologists, February 9th, 1940.

English progress in pest control. Subjects dealt with are :—Progress in winter washes and increased control of aphides, mites, capsids, etc. ; raspberry beetle control by derris ; nicotine control of apple sawfly ; quassia control of plum sawfly ; the use of calomel (mercurous chloride) for cabbage root fly and for onion fly ; control of flea beetles with derris dusts and naphthalene-silica dusts ; meta for slugs ; hot water treatment for narcissus fly, eelworm in bulbs, strawberries, chrysanthemums, etc. ; protection of dried fruit stores from *Ephesia* and *Plodia* infestation by spraying with a concentrated preparation of pyrethrins diluted with a highly refined white oil in atomized form ; the cultivation of good strains of pyrethrum.

990. MASSEE, A. M. 632.6/7 : 634.1/7

Notes on some interesting insects observed in 1939.

A. R. East Malling Res. Stat. for 1939, A23, 1940, pp. 70-3.

Brief notes are given of seventeen insects found on fruits in 1939. The tortrix caterpillar, *Argyroplote urticana* Hüb., occurred more commonly than usual and the raspberry moth, *Lampronia rubiella* Bjerk., caused serious injury to cultivated blackberries. The red leaf aphid, *Anuraphis crataegi* Kalt., was found to be widespread on two farms in Kent and must be considered an important pest. The Mediterranean fruit fly, *Ceratitidis capitata* Wied., was bred from larvae in apples in a garden at South Harrow, the type of injury being characteristic of that made by the apple fruit miner. Other maggots found in the fruit did not mature and no others hatched out. The fruits were collected and destroyed and the soil beneath the trees was treated. A possible explanation is offered by the presence of a greengrocer's shop in the vicinity.

991. BAERG, W. J. 632.732

Termite damage : preventives and remedies.

Bull. Ark. agric. Exp. Stat. 385, 1940, pp. 27, bibl. 10.

Termite damage to buildings in the United States is estimated at \$40,000,000 annually. It can be significantly reduced with the aid of galvanized iron or copper shields preventing termites from entering a building. Soil insecticides are still in the experimental stage, though some have already proved to be relatively useful.

992. THOMAS, I., AND JACOB, F. M. 634.75-2.753

The strawberry aphid—*Pentatrachopus (Capitophorus) fragariae* Theo., with notes on *P. potentillae* Walk. and *P. tetraerhodus* Walk.

Ann. appl. Biol., 1940, 27 : 234-47, bibl. 9.

The life history of the strawberry aphid in North Wales, which follows closely that in other districts, is described. Its power of migration and host plants are noted. Of aphides other than those mentioned in the title found on strawberries in North Wales *Macrosiphum solanifolii* Ashm. is much the most frequent.

993. KEARNS, H. G. H., AND MARTIN, H. 632.654.2 : 634.11 + 634.22

The control of fruit tree red spider mite.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 60-5, bibl. 4.

Control on plum and on apple of the fruit tree red spider mite (*Oligonychus ulmi* Koch.) suggested is (1) the use of winter ovicides, e.g. tar-petroleum oil wash, dinitro-ortho-cresol petroleum wash, lauryl-rhodanate petroleum oil, and β -butoxy- β -thiocyanodiethyl ether-petroleum oil, the appropriate strengths being detailed here, and (2) the use of petal-fall contact washes which will vary with apples according to the sulphur shyness of the variety and with plums according to the presence or absence of plum sawfly. Thoroughness of spraying in all cases is essential and notes are given as to how this can be ensured.

994. DICKER, G. H. L. 632.78 : 634.71

The morphology and biology of the bramble shoot-webber, *Notocelia uddmanniana* L. (Tortricidae).

Ann. appl. Biol., 1939, 26 : 710-38, bibl. 14.

This is a considerably more detailed account of the bramble shoot-webber, its morphology and biology, than that given by the author in the annual report of the East Malling Research Station for 1938 (A22, pp. 191-8 ; *H.A.*, 9 : 877).

995. SUIRE, J. 632.78 : 634.1/7
 Contribution à l'étude de quelques coleophores parasites des arbres fruitiers.
 (Some *Coleophora* parasitic on fruit trees.)
Ann. Épiphyt. Phytogén, 1940, 5 : 309-38, bibl. 86.

The author gives notes on the morphology of some 10 species of *Coleophora* (small *Lepidoptera*), on the damage caused by them in France, on the parasites known to prey on them, and rather briefly on other methods of control found useful.

996. MARSHALL, G. E. 632.78 : 634.11
 Some newly discovered habits of the codling moth.
J. econ. Ent., 1940, 33 : 200.

Some hitherto unknown habits of the codling moth and the method by which they were discovered are described. It is shown that under abnormal conditions, in this case the absence of apples, codling moth will mature on fruit buds and spurs, sap shoots, 4-year-old growing apple wood, mummied apples over 6 years old which had shrivelled on the ground without rotting and, as already known, on leaves alone.

997. HARMAN, S. W. 632.78
 Experiences in New York with non-residue sprays for the codling moth.
J. econ. Ent., 1940, 33 : 340-2.
 SIEGLER, E. H.
 Laboratory studies of codling moth larval attractants. 632.78
J. econ. Ent., 1940, 33 : 342-5.

Under conditions obtaining in north-western New York it has been found that nicotine mixtures for codling moth obviate excessive spray deposits and may be even more effective than lead arsenate. In the second article reports of laboratory experiments indicate the value of brown sugar as an attractant for codling moth larvae, when used with lead and calcium arsenates, nicotine bentonite and phenothiazine. With derris and pyrethrum it was not so effective.

998. GNADINGER, C. B., MOORE, J. B., COULTER, R. W. 632.78 : 632.951
 Experiments with pyrethrum for the control of codling moth (*Carpocapsa pomonella* L.).
J. econ. Ent., 1940, 33 : 143-52, bibl. 10.

Experiments with pyrethrum for control of codling moth in U.S.A. are described. Pyrethrin-oil spray was used for controlling pupae and over-wintering larvae and pyrethrum dust in conjunction with oil sprays, for control of adult moths, eggs, newly-hatched larvae and mature larvae. [From authors' summary.]

999. GINSBURG, J. M. 634.11-2.95
 Certain semi-refined oils for summer spraying on apple trees.
J. econ. Ent., 1940, 33 : 331-6, bibl. 11.

After several years' experiments with petroleum distillates of varying refinements for the control of codling on apple trees it is concluded that a semi-refined paraffin distillate of about 70 viscosity and about 83% sulphonation, possessing a viscosity index of 90-100, is just as safe for summer spraying of apple trees as is the highly refined oil. It costs less than half as much.

1000. PAILLOT, A., AND OTHERS. 632.78 : 634.1/2
 Le carpocapse (*Laspeyresia pomonella* L.) dans les principales régions fruitières de France. (The codling moth in the chief fruit growing districts of France.)
Ann. Épiphyt. Phytogén, 1940, 5 : 106-256, bibls.

One whole number of the *Annales des Épiphyties* is devoted to a biological study by 8 authors of the incidence of the codling moth in the different French fruit-growing areas and to the measures adopted or recommended for its control. M. Paillot summarizes and comments in the last article.

1001. MARANI, M., GOIA, G., AND GERBALDI, C. 632.78
 Ulteriori prove sull'efficacia di polveri oleo-solfo-calceiche nella lotta contro la *Cydia molesta* Busch. (**Further tests of oil dusts for controlling *C. molesta*.**)
 [Summaries in English, French and German.]
Riv. Frutticoltura, 1940, 4: 1-8.

A continuation of experiments first described *ibidem* 2: 145-51; *H.A.*, 8: 1061, on the control of the oriental fruit moth on peach with oil dusts. In these trials the best control (6.6% damaged fruit) was achieved by powdering throughout the season with sulphur, hydrated lime, talc and oil (+lead arsenate at earlier dates); the control afforded by powdering only in the month before picking was not so good (12.7% damaged fruit); but that given by cutting out the infested shoots nearly equalled that from continuous powdering (7.2% damaged fruit). Damage on untreated trees amounted to 21.7%. The cutting out of infested shoots was found to be much the most economical method.

1002. BRUNSON, M. H. 632.78: 632.96
Mass liberation of parasites of the oriental fruit moth for immediate reduction of infestation.
J. econ. Ent., 1940, 33: 346-9, bibl. 2.
 YETTER, W. P., AND ALLEN, H. W. 632.78: 632.96
Effect of larval parasitization of the oriental fruit moth on infestation.
Ibidem, 1940, 33: 349-53, bibl. 3.
 DRIGGERS, B. F. 632.78: 632.96
Oriental fruit moth larval parasitism as related to infestation.
Ibidem, 1940, 33: 353-7.

Investigations in peach orchards on the biologic control of *Grapholitha molesta* by the use of *Macrocentrus ancylicorvus*, *Bassus diversus* and *Glypta rufiscutellaris*.

1003. BOVIEN, P., AND STAPEL, C. 634.22-2.793
 Forsøg med Bekæmpelse af Blommehvepsen (*Hoplocampa fulvicornis*).
 (**Plum sawfly control.**) [English summary $\frac{1}{2}$ p.]
Tidsskr. Planteavl, 1940, 44: 700-30, bibl. 12.

In Danish trials 2 sprayings with 3.0% quassia and 0.5% soft soap at petal fall and 8 days later and one spraying with 0.5-1.0% quassia both gave satisfactory control of the plum sawfly. Moreover just as good results were obtained by spraying in full bloom as by spraying several days after petal fall. Even spraying with a decoction of quassia chips twice extracted was successful. Quassia is moreover compatible with and can be used with lime-sulphur. Results of spraying with derris as well as with nicotine were good but not so good. Lead arsenate gives good control but is apt to damage the foliage of some varieties. Cryolite was less effective.

1004. CHAPPELLIER, A. 632.693.2
 Essais sur l'empoisonnement de la souris et des mulots avec l'arsenic et la strychnine. (**Trials of arsenical and strychnine poison baits for mice.**)
Ann. Épiphyt. Phytogén., 1938, 4: 199-209.

An account of successful attempts to poison mice with grain treated with arsenic and strychnine. Owing to the danger to game and useful animals the use of arsenic is deprecated but strychnine used in rather stronger doses would appear to be efficacious without endangering other livestock.

1005. MILLER, D. 632.51: 632.96
Control of weeds by insects. Effect on blackberry, ragwort and piripiri.
 Reprinted from *N.Z. J. Agric.*, 1939, 58: 37, 39.

Attempts made by the Cawthron Institute to control blackberry by means of imported insects had to be given up, as there was too great a danger of related plants of economic value being attacked. Ragwort-seed fly shows some promise for the control of ragwort. Experiments to control piripiri (or bidi-bidi) by means of the Chilean sawfly are in progress. Field liberations have already been made, but it is too soon to expect anything definite.

1006. PATERSON, W. G. R.

632.51

Bracken control.*J. Minist. Agric. Lond.*, 1940, **47**: 55-62.

Experiments with cutting and bruising machines near Stirling and in Renfrewshire since 1934 show that the best way of weakening and so finally eradicating bracken is by the use of a cutting machine, which completely severs the frond from the underground rhizome. If the bracken is cut once only the best time is just before the frond has completely uncurled. Two cuttings are generally better and in this case the second should be carried out as soon as the second crop of fronds are of sufficient size. Of 9 cutting machines used the Collins Junior proved best in these experiments. Other methods of control are bruising machines—fairly satisfactory; spraying with sulphuric acid 10% solution or spraying or dusting with sodium chlorate either from the ground or by autogiro from the air—too expensive; cultivation and keeping ground under cultivation; and possibly by mixed grazing, sheep alone proving too light to keep the bracken down. It is pointed out that bracken, before it gets too strong and fibrous, can be made into silage. The addition of molasses is advisable. It may well also be used as litter for cattle, as a good covering for potatoes, as compost and as a source of potash, its ash being rich in that constituent.

1007. MARTIN, E., AND CUPERY, H.

632.954

Preliminary tests conducted to evaluate action of sulfamates as weed killers.*Agric. News Letter* (Du Pont, Wilmington, Delaware), **8**: 23-4.

Preliminary trials on small plots indicated that solid ammonium sulphamate and solid sulphamic acid applied by hand spreading were more effective as weed killers on a weight basis than solid sodium chloride and approximately equal to sodium chlorate.

1008. KEARNS, H. G. H., AND MARTIN, H.

632.95 : 634.1/2

Spraying farm orchards in war time.*A. R. Long Ashton agric. hort. Res. Stat.* 1939, 1940, pp. 35-41, bibl. 7.

Referring mainly to cider orchards in the west of England the authors make certain recommendations, elaborating them with details of composition of tar-petroleum oil wash, dinitro-ortho-cresol wash, lime-sulphur and lead arsenate wash, bordeaux and lead arsenate wash, and with notes on apparatus and costs. *Newly planted orchards*.—The application of an oil wash from mid-December up to mid-March, i.e. just before bud burst, is recommended. *Established cider orchards*.—If not previously sprayed they should be treated as above for 2 or more successive seasons. Spraying will then largely depend on the incidence of pests and diseases, and notes are given for treatment under particular circumstances. *Old farm orchards*.—Sometimes these are not worth spraying, but if renovated in part by planting up with young trees they must receive proper attention. *Mixed farm orchards*.—Care is necessary, especially not to use winter washes too late.

1009. KEARNS, H. G. H.

632.94

A simple connector for overland steel spray mains.*A. R. Long Ashton agric. hort. Res. Stat.* 1939, 1940, pp. 57-9.

A useful note on the substitution of metal connections for the standard cap and lining fitted normally to each end of the normal armoured rubber hose lengths which connect steel spraying mains to each other. The new metal connection consists of 2 main portions, a bush and a cap and lining. These are described in detail and illustrated.

1010. STATENS FORSØGSVIRKSOMHED I PLANTEKULTUR.

632.95

Kemikalier til Bekæmpelse af Plantesygdomme og Skadedyr. (Chemicals) used in the control of plant diseases and pests.)*Medd. Forsøgsv. Planteek. Kbh.* **250**, 1940, pp. 12.

These are directions on the use of common Danish fungicides and insecticides as well as of special preparations. Notes appear on copper compounds, sulphur, arsenic, fluorine and nicotine preparations, rotenone, pyrethrum, quassia and mercury preparations, paraffin oils, tar oils, carbon disulphide preparations, formalin, salicylic acid, crude spirit, soap, glue and canker

paints. Spreading agents are discussed briefly. A short paragraph is devoted to minor nutrients.

1011. MARTIN, J. T. 632.951
The problem of the evaluation of rotenone-containing plants. V. The relative toxicities of different species of derris.
Ann. appl. Biol., 1940, 27 : 274-94, bibl. 26.

The relative toxicities to *Aphis rumicis* of different species and varieties of derris root have been determined. A *Derris elliptica*, Changi root, was two and one-half times, a *D. malaccensis*, Sarawakensis root, was one and three-quarter times, and a *D. elliptica*, Sarawak creeping root, was one and one-quarter times as toxic as a *D. malaccensis*, Kinta root. Preliminary trials showed that the relative toxicities of three of the roots to a stored products insect, *Oryzaephilus surinamensis*, were of a similar order. All toxicity data have been subjected to statistical analysis. Various methods suggested for the chemical evaluation of derris have been examined and discussed. Methods based upon optical rotation values have been shown to fail in the evaluation of roots and resins of different species, while the method of Jones and Smith (1936), in which a definite toxic value is given to the non-rotenone fraction of the derris extract, has been found to be inadequate when applied to the roots under consideration. The determination of the percentage "rotenone equivalent" values of the roots, based upon the alkaline fractionation of the resins and the toxicities of the deguelin and toxicarol fractions relative to that of rotenone, has given a reasonably close estimate of the toxicities of the derris roots examined. The application of the method to the assessment of the toxic value of derris resins is described. [Author's summary.]

1012. WORSLEY, R. R. LE G. 587.38 : 615.778/9
The histology and physiology of rotenoids in some Papilionaceae I.
Ann. appl. Biol., 1939, 26 : 649-83, bibl. 5.

All available parts at all available stages of growth of 22 species of *Papilionaceae* were examined microscopically for the presence of rotenoids. Fourteen contained them, namely *Mundulea sericea*, 7 *Tephrosia* spp., 4 *Derris* spp., 2 *Millettia* spp. The parts in which they occur are summarized in a table.

1013. MARSH, R. W. 632.952.1 : 634.11
Notes on the use of certain sulphur preparations in apple spraying.
A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 42-51, bibl. 10.

The author discusses the sulphur powders and sprays which have lately come to the fore, largely as by-products of gas purification in U.S.A., noting their types, properties and methods of application. In the U.S. they are used mainly for inclusion in a long series of post-blossom arsenical sprays. From results of English trials these pastes and powder would appear to be somewhat inferior to lime-sulphurs yielding equivalent sulphur deposits. While lime-sulphur is usually more phytocidal, the other sulphur products do not obviate spray damage.

1014. POLLACCI, G., CIFERRI, R., AND GALLOTTI, M. 632.95
Lo zolfo-proteinato di mercurio come fitofarmaco autarchico. (Sulphur proteinate of mercury as a substitute for copper salts in plant disease and pest control.)

Att. Ist. bot. Univ. Pavia, 1939, 11 : 135-52, bibl. 70.

The authors in this preliminary report give a brief account of the different mercury compounds or combinations already in use in agriculture and then proceed to discuss the preparation and use of a new polyvalent mercury product, sulphur proteinate of mercury. The materials necessary for its preparation are casein, sulphur, caustic soda and chloride of mercury. The advantages claimed for this product over sulphur and copper salts as also over many other insecticides are here set out. It is claimed not only that in Italy its manufacture and use should set free large sums of money at present spent on the importation of copper salts, but also that its effects will be better than those of the copper salts.

1015. ANON. 632.95
 De ontwikkeling en toepassing van minerale olie-emulsies. (The development and future of mineral oil emulsions.)
Fruittceelt, 1940, 30 : 85-7.

The first use of mineral oils in the control of insect pests was probably in California in 1865. The various stages of progress culminating in the modern oil emulsions and the development of the spray nozzles are outlined in general terms.

1016. BERRY, W. E. 632.952.1
 Spray injury studies. Progress report II. The effects of time and temperature on the production of hydrogen sulphide during atmospheric decomposition of lime sulphur.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 52-6, bibl. 6.

Laboratory experiments on the effect of temperature on the production of hydrogen sulphide from 2% lime-sulphur solution and of the effect of time and temperature on the rate of hydrogen sulphide production by 2% lime-sulphur during decomposition by atmospheric air indicate that, if H_2S is a factor in spray injury, it will exert its maximum effect very shortly after application of the spray. In practice decomposition would probably be accelerated by the exposure of a greater surface of solution to the air and in addition H_2S production would tend to increase as the result of increased CO_2 concentration due to leaf respiration.

1017. OVERLEY, F. L., OVERHOLSER, E. L., AND ALLMENDINGER, D. F. 634.11-2.95

Injury to the tree and fruit from different sprays applied in 1939.

Proc. 35th annu. Meeting Washington St. hort. Ass. 1939, Wenatchee, Wash., 1940, pp. 41-6, bibl. 3, being *Sci. Pap. Wash. St. Coll. Agric.* 433.

The spray injuries of 1939 were discussed under the following heads :—(1) Immature fruit drop from oil sprays. (2) Oil spray injury to maturing fruit. So-called low grade spray oils affected the general appearance of the fruit, causing russetting and giving an oil soaked appearance and heavy corking of lenticels. (3) Photosynthetic activity of the foliage as affected by oils in the sprays. Sprays of 50 seconds Saybolt viscosity and less had no effect on foliage after 48 hours but light-medium to heavy oils caused foliage damage and so may affect the fruit yield and size the following year. (4) Other types of spray injury to apple fruit and foliage. Certain promising organic material sprays (not more precisely specified) cannot without damage be used following oil sprays. (5) Dormant oil spray injury. Excessive use of heavy oil sprays especially of the quick-breaking type may reduce crop production and size and colour of fruit. (6) Fruit injury from codling moth by worms and stings. A table is given showing the results of fruit injury by codling moth from 14 different spray programmes.

1018. RAUCOURT, M., TROUVELOT, B., AND CASTETS, G. 632.951

Les résidus d'arsenic sur les pommes et les poires traitées contre le carpocapse.

(Arsenical residues on apples and pears treated for the control of codling.)

Ann. Épiphyt. Phytogén. 1938, 4 : 337-56, bibl.

Figures of arsenical residues on apples and pears from trees treated for codling moth with arsenical sprays at varying lengths of time from the date of harvest are reported from some 18 districts. The good effects of wiping and washing the fruit are briefly mentioned.

1019. EIDELMAN, Z. M., AND LAVRUK, S. 634.11 : 632.95 : 612.015

The activity of oxidizing ferments as a sign of poisoning of vegetable tissues by arsenic and fluorine compounds. [Russian, English summary 26 lines.]

Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 285-96, bibl. 12.

Investigations were conducted on apple leaves of several Russian varieties grown at the Mitchurin collective farm, which showed varying degrees of tolerance to arsenic. Arsenic was applied to the leaves by means of injection as well as by other methods. It was shown that peroxidase activity rose with increased toxicity. This ferment reaction was not specific for the action of arsenic compounds, abrupt changes in peroxidase activity being also observed in apple leaf tissues affected by scab and in cotton leaves poisoned with fluorine compounds and crude oil.

Varieties with a high peroxidase activity were found to be especially susceptible to arsenic injury.

1020. RASMUSSEN, E. J. 634.23 : 581.192 : 632.95
The effect of several spray materials on the size, color and per cent solids of the fruit of the Montmorency cherry.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 367-70, bibl. 4.

VEGETABLE GROWING,* STIMULANTS, ETC.

1021. LESLIE, W. R., AND GODFREY, W. 635.1/7
Vegetables for prairie farms.
Publ. Dep. Agric. Canada 663, 1939, being Fmrs' Bull. 83, pp. 75.

This is a practical guide to a dry-land prairie gardener on growing many different types of vegetables, mushrooms, peanuts, melons, herbs and condiment plants. Notes appear on all the important points in the cultivation of the different plants under dry-land conditions from seed and soil treatment to harvesting and include irrigation, mulching, snow trapping, sheltering, use of frames, rotation, implements and even canning, drying and storing of the vegetables.

1022. PAVLOV, I. P. 635.62/4 + 635.15 + 633.841 + 635.25 + 635.262 + 635.21
Vegetable growing in Daghestan. [Russian.]
Proc. Daghestan Agric. Inst. Makhach-Kala, 1939, No. 1, pp. 8-12.

Of all the vegetable growing areas in U.S.S.R. Daghestan is geographically the most suitable. Many of the vegetables grown are renowned for their size and quality and are in great demand in other republics. 40% of the total area under vegetables (beans and potatoes excluded) is occupied by tomatoes, next come cucumbers (15%), cabbage (12%), onions (9%), carrots (4%), pepper and egg plants (3%), other vegetables (17%). A long growth season lasting 259-286 days makes cultivation of annual crops possible. The main tasks of the vegetable breeder are as follows :—*Tomatoes*.—Early ripening and high yields ; better varieties for export and canning ; immunity against diseases associated with degeneration or other causes ; introduction of new varieties and varietal tests. *Cucumbers, gourds and melons*.—Varietal tests, selection and propagation. *Radish*.—Seed propagation. *Egg-plant, peppers, lettuce*.—Selection. Propagation of a local *onion*, whose chief characters are firmness and violet-coloured bulb. Clonal selection of *garlic*. Varietal tests with *cabbage*, and invigoration of *potato* varieties by means of seed propagation.

1023. DOLGOPOLOV, M. 633.5/6
Rise in the productiveness of staple plants in U.S.S.R. [Russian.]
Soc. Agric. Moscow, 1940, No. 4, pp. 98-108.

Figures of production of industrial crops before 1914 and in post-revolution Russia. The crops concerned are cotton, flax, hemp, sugar beet, and sunflower.

1024. BEWLEY, W. F. 635.1/7 : 631.544
Vegetable crops under glass.
Home Front Ser. 6, 1940, pp. 31, Country Life Ltd., London, 6d.

Into this useful booklet Dr. Bewley has managed to compress the essential information necessary for the cultivation of many kinds of vegetable under glass in greenhouse and frame.

1025. BEWLEY, W. F. 635.1/7 : 631.544
War time crops under glass.
Market Gr. London, 1940, 17 : 18 : 9-10.

In a talk to growers at Worthing Dr. Bewley made many valuable suggestions for vegetable cropping under glass. Success with tomatoes depends on :—(1) An efficient system of overhead damping. (2) The use of straw placed vertically in the soil. (3) The application of dried blood feeds at the correct period of growth. (4) The use of peat as a mulch. (5) The use of sink pots under certain conditions. Difficulty in setting the bottom trusses is due to incorrect watering in the early stages. Careful ball watering and no flooding in the early stages is advised. Sink pots are used to restrict root growth on soils where watering has given rise to rank growth. The

* See also 848.

Cheshunt technique will grow tomatoes satisfactorily in any part of the country. Lettuce shows a handsome profit if well grown. It must be given a good start; it should be grown at 60° F. for 21 days and finished off at 50°. Lettuce sown outside never prospers when transplanted to glass. It should be sown under glass but will fail to germinate at a high temperature. The ventilators should be open from 7 a.m. to 4 p.m. except in the coldest weather. It pays to pull out tomatoes before the August glut and plant a long day lettuce such as Green Frame for cutting in September when the price would more than balance the loss on tomatoes. Advice is given on watering and general management of lettuce and on the suitability of particular varieties for different purposes.

1026. BEWLEY, W. F.

635.64 + 635.63 + 635.52

Experimental results of 1939.

Twenty-fifth A. R. exp. Res. Stat. Cheshunt 1939, 1940, pp. 14-27.

Tomatoes.—Four years' work has shown the great value of cardboard containers (7 in. × 7 in. × 7 in.) for growing glasshouse tomatoes in old unsterilized soil and, where growth is too strong in steam-sterilized soil, in helping to control growth. In unsterilized soil they restrict root action at the beginning of the crop, improve quality and give earlier crops than planting direct in the ground. The crop yield was increased after steaming by the application of bone meal + sulphate of potash, but the addition of hoof and horn and stable manure had a depressing effect. Blotchy ripening was again found to be intimately connected with potash deficiency. In the variety trials the leaf mould resister E.S.1 × Up-to-date and Radio cropped excellently.

Cucumbers.—Crop weights from ridged beds were much better than those from single mounds. Inserting straw in almost vertical walls across the beds with the haulms vertical keeps the bed open and maintains a healthy root action. At the same time, while the addition of straw to a mixture of soil and horse manure increases the yield of cucumbers, the use of straw instead of stable manure depresses it.

Lettuce.—A new hybrid, Cheshunt Early Giant × Green Frame, grew better than Cheshunt Early Giant in a rich steamed soil. Experiments in the cucumber house with other vegetables, carrots, turnips, broad beans, cauliflower and dwarf beans were not entirely successful owing to the breakdown of a boiler. They are to be repeated next winter.

1027. WILLIAMS, P. H., OYLER, E., WHITE, H. L., AINSWORTH, G. C., SELMAN, I. W.

631.544 : 632.4 + 632.8

Plant diseases [at Cheshunt in 1939].

Twenty-fifth A. R. exp. Res. Stat. Cheshunt 1939, 1940, pp. 28-38.

Williams reports preliminary work on two wilt diseases of the tomato, found in Guernsey. It would appear that cucumber root rot is largely due to unsuitable physical conditions of the soil. When weakened by this the plants are attacked by *Fusarium* spp.

Oyler concludes from results obtained that some degree of control of *Verticillium* wilt of chrysanthemum can be got by growing at a higher temperature than is normally used.

White deals with *Verticillium* wilt of the carnation, work on which has now been temporarily suspended. This work included transmission tests to 5 different species of *Dianthus*. Of these *D. deltoides* was completely immune and *D. caryophyllus* highly resistant.

Ainsworth deals with virus diseases of leguminous plants and with transmission experiments with viruses from monocotyledons.

Selman's work suggests that so-called "running out" of chrysanthemums may be due to virus infection. Dealing with tomato viruses he notes that recent data agree consistently with earlier data on the following points:—(1) Complete artificials without potash always induces the greatest number of streaked plants; (2) complete artificials plus stable manure always induces more streaked plants than does complete artificials alone; (3) complete artificials without nitrogen tends to give the smallest number of streaked plants.

1028. SPEYER, E. R., READ, W., AND ORCHARD, O.

631.544 : 632.6/7

Animal pests [at Cheshunt in 1939].

Twenty-fifth A. R. exp. Res. Stat. Cheshunt 1939, 1940, pp. 39-44.

The authors report on the varying success achieved with different control methods and materials against the following:—caterpillars (derris and lonchocarpus); aphids (HCN, pyrethrum

powder); wireworms (CS₂); woodlice (castor meal bait treated with Paris Green); cucumber rootflies (dichlorodiethyl); mushroom pests (derris and pyrethrum); capsids; thrips (pyrethrum, naphthalene); carnation tortrix caterpillars (tetrachlorethane vapour unsuccessful, lead arsenate spray considerable promise).

1029. YODEN, W. J. 631.544 : 581.084.1 : 519

Experimental designs to increase accuracy of greenhouse studies.

Contr. Boyce Thompson Inst., 1940, **11** : 219-28, bibl. 8.

The author stresses the necessity for care in the lay-out of greenhouse studies. He shows a number of new arrangements of latin squares with missing rows which should be found useful in such work.

1030. IBRYAEV, I., AND ANTONYUK, A. 631.544

Utilization of industrial waste for heating in vegetable production in Russia.

[Russian.]

Soc. Agric. Moscow, 1939, No. 10, pp. 63-72.

A study was made at the Timiryazev Agricultural Academy of temperature conditions in different types of frames and in open beds heated by warm water. The results may be summed up as follows:—After running through the heating pipes the temperature of water, initially 37° C., was reduced to 19·9° C. Water-heated frames 10 cm. deep had a soil temperature of 23·8° C. and an air temperature of 20·6° C. Hotbeds with 80 cm. layer of manure had a soil temperature of 22·8° and air temperature of 19·9°. Open beds heated with water having an initial temperature of 30° C. had a soil temperature of 21·9° C., and unheated open beds of 14·5° C. The material used was inexpensive, namely 5 inch earthenware pipes laid 80 cm. apart and 25 cm. deep. The growth of the plants above and between the pipes was much the same. Asbestos-concrete pipes are considered as even more suitable than the pipes used in the experiments on account of their longer life, cheapness and the ease with which they are laid. Soil temperature in the heated frames in winter was 21° C. when the initial water temperature was approximately 35° C. Despite the low temperatures in winter (–35° C.) all the more common vegetables could be grown successfully in the water-heated frames. In addition tender vines, roses and pinks could be grown in the open under Moscow conditions (winter 1938-9) by heating with water piping.

1031. ALBRECHT, W. A., AND SCHROEDER, R. A. 635.1/7 : 581.084

Colloidal clay culture for refined control of nutritional experiments with vegetables.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 689-92, bibl. 6.

A discussion of the most suitable medium for growing vegetables for nutritional experiments is followed by a consideration of the qualities and preparation of colloidal clay. The authors consider that colloidal clay presents itself as an instrument for the complete control of cultures for vegetable growth in the study of dietary importance of the chemical composition of such crops.

1032. POST, K. 631.544 : 631.548

A comparison of methods of watering greenhouse plants and the distribution of water through the soil.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 1044-50, bibl. 1.

Sub-irrigation on a bench made waterproof by asphalt paper and paint and in cement beds was found to be a method more economical of time and water than the ordinary one of top watering. Chrysanthemums grew equally well by both methods. Tensiometer cups in the middle of the bed showed when watering was necessary.

1033. POLLACCI, G. 631.544

Lo sfruttamento delle acque termali a vantaggio della orticoltura italiana.

(The use of natural hot springs in Italian horticulture.)

Att. Ist. bot. Univ. Pavia, 1939, **11** : 303-10, bibl. 1.

The firm of Sgaravatti makes use of the thermal springs of Abano, near Pavia, Italy, for heating its horticultural frames. Naturally the water itself, being full of various salts, cannot be used

directly on the plants nor can it be used for circulating in the heating pipes which would soon become blocked. It is however collected in one central vat in which are pipes containing ordinary water. The latter is heated by contact and is thence distributed throughout the frames. It is suggested that where such springs exist they might well be harnessed for use in this manner and so provide a much cheaper source of heat than is afforded by imported coal.

1034. LEATHERMAN, M., AND BOSWELL, V. R. 631.346

The use of copper resinate as a treatment for paper pots.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 951-5, bibl. 9.

One objection to the use of paper pots is that cellulose-decomposing micro-organisms utilize the nitrates of the surrounding soil to break the paper down and plants cannot compete with them. Dipping the paper pots into carbon tetrachloride solution of the desired concentration of copper resinate, removing promptly and allowing the solvent to evaporate before using the pots resulted in much more satisfactory growth of tomatoes than where untreated paper pots were used.

1035. BOSWELL, V. R., TOOLE, E. H., TOOLE, V. K., AND FISHER, D. F. 635.1/7 : 631.531

A study of rapid deterioration of vegetable seeds and methods for its prevention.

Tech. Bull. U.S. Dep. Agric. 708, 1940, pp. 47, bibl. 13.

The data resulting from these storage experiments are offered in considerable detail. The results in general terms were :—After 110 days tomato seed was the most tolerant of combined high humidity and temperature and beet was next. Carrot, cabbage and bean seed were comparatively resistant ; onion was very sensitive. After 251 days at 78% humidity and 80° F. all seeds had deteriorated markedly except tomato, but even their rate of germination and vigour of seedlings was reduced. Under lower temperatures and humidities only onion and peanut showed marked losses. Germination response is shown to be dependent on the moisture content of the active tissues of the growing regions of the seed. The serious losses which occur from rapid loss of germination can be checked by drying the seeds and keeping them dry or by holding them at low temperature. Seeds removed from cold storage will deteriorate in a few days at high summer temperatures. At high humidity and temperature significant loss in germination was shown by seeds after the following periods :—cabbage, onion, 10 days ; sweet corn, spinach, tomato, peanut, 20 days ; carrot, 30 days ; kidney bean, 40 days ; lima bean, 80 days. There was practically no loss with beet after 110 days, but almost complete loss after the next examination date, 251 days.

1036. EDMUNDSON, W. C. 633.491

Potato production in the Western States.

Fmrs' Bull. U.S. Dep. Agric. 1843, 1940, pp. 27.

In the West most of the potatoes are grown under semi-arid conditions and irrigation is essential for maximum yield. The following crop rotation is often used :—lucerne 2-7 years, potatoes 1 year and grain 1 year. The cultural operations in connexion with the potato crop, i.e. soil preparation, irrigation, planting and spacing, cultivating, spraying and dusting, etc., are described. Irrigation water has been shown to have no effect on the vigour and vitality of the seed. Seed is normally dipped before planting in mercuric chloride, acid mercury dip or formaldehyde. Seed is usually cut. The best practice is to cut by hand with the help of a rigidly fixed knife blade. The sets are generally planted as soon as cut, but they may be cut some time in advance of planting if properly suberized by being allowed to heal at 60° to 70° F. with an 85% atmospheric humidity. One of the best places for this is the potato storage cellar. Eight or ten days are necessary for suberization after which the seed can be planted or stored in a cool temperature. Cut seed for suberization should not be stored or handled in bags because of lack of ventilation. Two days after cutting the pieces should be poured from one container to another to prevent them sticking together. Seed suberizes naturally if planted in soils having suitable temperature and moisture, but suberization is a good insurance against seed piece decay where potatoes are planted in dry or hot soils. Details are given of the varieties preferred in the different States and of particular features of different regions.

1037. SHARP, W. S. 633.491

Potatoes on demonstration allotments in the county of Durham.

Gdnrs' Chron., 1940, 107 : 83-4.

Some data gathered from potato trials held for the past 20 years on demonstration allotments in Durham are given. Manurial treatment is dung at the rate of 16 tons per acre either dug in previously or put into the furrow at planting; supplemented at planting by superphosphate 3 parts, sulphate of ammonia 1 part, sulphate of potash 1 part, steamed bone flour 1 part, all by weight, applied at the rate of $2\frac{1}{2}$ oz. per sq. yd. For second earlies and main crop the most satisfactory planting distances are 30 inches between the rows and 1 foot between the sets. On good soils Kerr's Pink and other strong growers yield more heavily with wider spaces, especially if the haulm can be supported upright through the growing season. A potato crop on deeply trenched soil will yield 1 lb. per root or 7 tons per acre more than on shallow dug soils. The best results are obtained from sets from 2 to 3 oz. in weight. Cut sets give more ware sized potatoes though there is little difference in total yield between cut and uncut tubers. Sprouting the sets is regarded as important; all sprouts except one should be rubbed off. There is no better indication of the leaf curl virus than sprouting. A strong sturdy sprout may be considered virus-free, safe from over-ripeness and a sign that parent crop was not blighted. Only immune potatoes are used and in the recent trials Kerr's Pink was the best all round main crop but for some reason unknown always failed on the two best cultivated plots. Dunbar Rover gave the heaviest individual return.

1038. JOHNSON, G. C. 633.491

Cutting potato sets.

Gdnrs' Chron., 1940, 107 : 82.

The ancient practice of dipping cut potato sets into some drying material such as lime, soot or wood ash is unsound. Cut tubers for planting must heal up quickly to prevent the entrance of harmful organisms. A condition necessary for this quick healing is a moist warm atmosphere. Though some varieties will heal easily under adverse conditions, all will heal under the right conditions. To achieve these the temperature of the cutting shed should be maintained between 50° and 55° F. and the cut tubers immediately covered with wet sacks for 12 hours, after which the tubers may be returned if required to dry conditions. If a greenhouse or cold frame is available the sacking is not necessary provided the house or frame is well damped down. Although each eye will make a set it is preferable only to halve the potato with a cut from the rose end to the heel. [Much experimental work on potato set cutting is described in the *Journal of the Ministry of Agriculture*, London, 1925, 31 : 1012-21. The scientific problems involved in the natural healing process are discussed in *Annals of Applied Biology*, 1923, 10 : 96-115.]

1039. KUZMENKO, A. A. 633.491-1.541

Some experiments on potato grafting.

C. R. Acad. Sci. U.R.S.S., 1939, 25 : 802-4, bibl. 2.

The operation of grafting potato tubers in Kiev was done in three ways: the cuts were wedge-shaped, segmented or cylindrical. The latter method requiring a cork-drill (12 mm. in diameter) gave best results. All the plants thus obtained combined the characters of the stock (tuber) and scion (eye) varieties, both in the above ground parts of the plant and in the tubers. In most cases the influence of the stock was the stronger.

1040. McCUBBIN, E. N. 633.491

Influence of sprouts on plant emergence, growth, tuber development and yield of potatoes.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 860.

In experiments in New York, which will be reported in full in the *American Potato Journal*, plants emerged in the following order:—(1) from sprouted tubers, (2) from desprouted tubers, (3) from dormant tubers. As regards final yield, however, not only were tubers more numerous but their total weight was greatest from the desprouted seed. The greater number of tubers was apparently due to the larger number of stems per seed tuber resulting from desprouting.

1041. CORDNER, H. B., AND WARD, N. 633.491
Germination and decay of potato sets and tubers in controlled studies with special reference to high soil temperatures.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 874-8, bibl. 2.
 CORDNER, H. B. 633.491
Seed preparation and cultural treatments in relation to stand of plants in fall crop potatoes in Oklahoma.
Ibidem, 37 : 879-83, bibl. 1.

The autumn crop of potatoes is often a failure in Oklahoma owing to the excessive heat of the soil. In the first of the above papers controlled temperature studies in the laboratory and in the second field experiments during the last three years with Triumph potatoes in Oklahoma are described. The results of the laboratory studies indicate that the so-called seed piece decay noticeable under Oklahoma conditions is physiological in origin and that newly cut sets should be more satisfactory than whole tubers for this autumn crop, seeing that treatments such as cutting the tubers favour oxygen penetration into the tissue and generally favour germination at high temperatures. Similarly treatments tending to limit gaseous exchange have tended to encourage breakdown or decay of seed pieces; thus the factors of paraffined or suberized surfaces of cut sets and the less permeable periderm of uncut tubers are of this nature. The satisfactory effect of cutting the seed is borne out in the field experiments, reasonably prompt germination being essential for a satisfactory stand of plants in the hot soil. There is also some evidence that pre-sprouting the seed should be helpful. Delayed sprouting due to insufficient water in the soil results in low stands, but the success attained by irrigating soon after planting may also be due partly to the lower soil temperatures which result.

1042. KNOWLES, F., WATKIN, J. E., AND COWIE, G. A. 633.491-1.8
Some effects of fertilizer interactions on growth and composition of the potato plant.
J. agric. Sci., 1940, 30 : 159-80, bibl. 8.

The symptoms of scorch and premature dying off of tops of potatoes which occur on soils deficient in potash, when manured with nitrogen in conjunction with phosphates, are shown to be due to decreased absorption of potassium, which the interaction of these two elements induces. By increasing the soil nitrogen the adverse effects of the combination become more pronounced. Cowie's diagnosis from leaf appearances that these effects are due to potassium deficiency is, therefore, well founded, and his further observation that plants fertilized with nitrogen only suffer much less, is shown to be due to the increased absorption of potassium which such treatment induces. The mechanism of the interaction is at present incapable of precise explanation, but the relatively higher concentrations of nitrogen and of phosphorus in the dry matter of the roots of the young plants manured with phosphates and with nitrogen at a high level, suggests some poisoning of the plant, which inhibits the absorption of potassium to a suitable concentration for maintaining health. This would consequently adversely affect the absorption of sufficient amounts of nutrients necessary for growth. [From authors' summary.]

1043. SAMUEL, G. 633.491-2.14
Lightning injury to potato tubers.
Ann. appl. Biol., 1940, 27 : 196-7, bibl. 9.

A description is given of injuries to tubers caused when lightning struck a potato field in Lincolnshire. The injuries included splitting, superficial and deep burns, and in some cases a general killing of the pith tissues. [Author's summary.]

1044. NATIONAL INSTITUTE OF AGRICULTURAL BOTANY. 633.63
Strains of sugar beet.
Fmrs' Leaflet. Nat. Inst. agric. Bot. 5, 1940, pp. 4.

The object of this leaflet is to indicate to the farmer the best kind of sugar beet for his particular conditions. Sugar beet strains are classified in three fairly distinct types known as E, Z, and N. E type has very high root yields combined with a reasonable sugar content. Z types are especially bred for very high sugar content. N is a compromise between the two. A number

of varieties of each type are mentioned and notes given of their characteristics. When early sowing is necessary a non-bolting variety should be used.

1045. PROSCURA, S. S. 633.63-1.828

The effect of copper fertilizers on sugar beet yield on drained peat soil in Ukraine. [Ukrainian, Russian and English summaries.]

J. Inst. Bot. Kiev, 1939, Nos. 21-22 (29-30), pp. 421-7, bibl. 6.

In Ukrainian experiments conducted in 1936-8 by the Institute for Hydraulic Engineering and Improvement on intensely drained alkalitrophic marshland copper fertilizers greatly increased the yields of sugar beet. In addition to the normal dressing with phosphates and potash, 300 to 450 kg. of calcium pyrites per hectare applied in either autumn or spring gave a per hectare root weight increase of 65.4 to 138.4 centners.

1046. HUYSKES, J. A. 633.63-2.19

Physiologische ziekten van de suikerbiet veroorzaakt door foutieve bevoeiing.

(Physiological diseases of the sugar beet, caused by improper irrigation.)

[Dutch, English summary.]

Meded. Inst. Phytopath., Wageningen 88, reprinted from *Tijdschr. Plziekt.*, 1939, 45 : 204-22, bibl. 12.

Observations at Conesa, Rio Negro, in the Argentine and tests at Wageningen show that two diseases of the sugar beet, for which the names "sugar beet wilt" and "flooding disease" are proposed, are due to lack of water and to excess of water respectively. The wilt is marked by wilting followed by death and fall of leaves. The root tip loses its rigidity and shrinks and the fine lateral roots die. The main root either withers or rots. The "flooding disease" is marked by the yellow aspect of the whole plant. Each plant shows a circle of dead leaves, within which are many mature yellow leaves of upright habit. The innermost leaves remain green.

1047. WARINGTON, K. 635.13-2.19 : 546.27

The growth and anatomical structure of the carrot (*Daucus carota*) as affected by boron deficiency.

Ann. appl. Biol., 1940, 27 : 176-83, bibl. 8.

The author relates her experiments with carrots grown up to flowering point in van der Crone solution, noting the effect of absence of boron on development. The boron deficiency symptoms are discussed and illustrated.

1048. NEWHALL, A. G., AND CHITWOOD, B. G. 635.25 : 632.654.2

Onion eelworm rot or bloat caused by the stem or bulb nematode, *Ditylenchus dipsaci*.

Phytopathology, 1940, 30 : 390-400, bibl. 23.

Steam sterilization of soil is an expensive but appears to be a successful method of eradicating the onion eelworm. Treatment of soil with sulphur and with chloropicrin is more economical and has given some promise in preliminary tests.

1049. KNOTT, J. E. 635.25 : 631.828

The response of onions to manganese on unproductive peat soils.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 803-6, bibl. 6.

It appears likely from these experiments in New York State that the beneficial results of using sulphur on unproductive peats, slightly acid to alkaline in reaction, is largely due to the effect of the increased acidity on the availability of manganese. A cheaper remedy suggested is 100 lb. manganese sulphate per acre, either broadcast or, if the soil is dry, in solution.

1050. YOUNG, R. E. 635.31

The depth of planting asparagus and its effect on stand, yield and position of the crown.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 783-4.

Depth of planting at 2, 4, 6, or 8 inches was found in trials in Massachusetts to have no significant effect on yield or even on later position of the crown.

1051. HÜLSENBERG, H. 635.31 : 632.452
 Zur Frage der Spargelrostbekämpfung mit kupferhaltigen Spritzbrühen.
 (*Asparagus rust control in Germany with copper sprays.*)
Nachr. SchädlBekämpf, 1939, 14 : 65-72, bibl. 12.

Copper-lime sprays containing a sticker or spreader controlled asparagus rust in Germany, provided spraying was carried out at the right time. The author recommends the following programme :—Young plants should be sprayed a fortnight after the first appearance of *aecidia*, and twice again at three-week intervals. Pricked-out asparagus must be sprayed 10 days after pricking and once or twice again after a week or two-week interval. Three-year-old asparagus requires no less than three sprayings.

1052. ANON. 635.34
The garden in war time : Brassicas.
Gdnrs' Chron., 1940, 107 : 251.

Some useful hints on growing garden *Brassicæ* are given. The plants, cabbages, kale, broccoli, sprouts, etc., should be raised in boxes, from which they transplant better than from the open ground. They must be ready to plant out in early July at latest. Firm and deep planting down to the bottom leaves will save many during a bad winter and in really windy situations it is worth while staking them. A good soaking after planting should be given by watering between the rows and not on the plants. Nitrogen in the form of sulphate of ammonia or nitro-chalk should be given in spring when the soil begins to warm up, never in the autumn or they will become soft. The soil should have been well manured and limed for the previous crop but if deficient a dressing may be given at planting time and hoed in when the soil has to be drawn up to the plants.

1053. WALTON, C. L. 635.34 : 632.77 : 615.732.621
Field trials for the control of the cabbage root fly, 1937-1939.
A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 66-71, bibl. 3.

Great success attended attempts to control injury due to the maggots of the cabbage root fly (*Delia (Hylemyia) brassicae* Bouché) on sprouts and cauliflowers in field trials near Evesham and at Long Ashton by the application of a 4% calomel dust. It appears to be important that such applications should be made as soon as possible after the plants are set out, especially during sunny weather. Chloric acid (0.1%) applied soon after setting out failed to give protection.

1054. DEARBORN, C. H. 635.35 : 632.19 : 631.811.6
Magnesium deficiency in cauliflower in Delaware County, New York.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 773-7, bibl. 5.

It is concluded from these studies at Davis, Calif., that a chlorosis and abscission of the lower leaves of cauliflower were due to inadequate magnesium. There are indications that this chlorosis can be avoided by the application of at least 300 lb. magnesium oxide per acre.

1055. ROLAND, G. 635.41 : 632.8
 Bijdrage tot de kennis der virusziekten van de spinazie. (*Spinach viruses.*)
 [French summary 2 pp.]
 Reprinted from *Tijdschr. PlZiekt.*, 1939, 45 : 260-74, bibl. 15.

In certain parts of Holland spinach is attacked by two virus diseases, namely beetroot chlorosis and mosaic of spinach. Their symptoms are discussed.

1056. REIMERS, F. E. 635.52 : 581.145 : 612.014.44
Phasic development in various biological groups of *Lactuca sativa* var. *capitata*.
C.R. Acad. Sci. U.R.S.S., 1939, 25 : 790-3, bibl. 2.

1937-8 experiments at the Laboratory of Plant Physiology, Institute of Garden Crops, showed that :—(1) Under natural daylight conditions (Moscow) in a given variety plants were much alike in their morphological characters and developed flower shoots nearly at the same time. (2) On curtailment of daylight (10-14 hours) the plants within a given variety showed considerable difference as regards their morphological characters and time of ripening. (3) In the varieties

Ideal and Eier Gelber, given a 14-hour day, the formation of flower shoots took more time (from the beginning of this process in the first plant till its completion in the last) than it did in the progeny of early and late ripening strains. Further selection of plants on these lines is advocated.

1057. WOODMAN, R. M. 635.52 : 631.8

The nutrition of lettuces grown as sand cultures under glass.

Ann. appl. Biol., 1940, **27** : 5-15, bibl. 7.

May King lettuce has been shown to respond well to nitrogen and phosphorus both as regards yield and earliness of maturity, but to make practically no response to potassium over a wide range of concentrations. Cheshunt Early Giant lettuce behaved similarly, but no development of purple flushes or tints took place with this non-tinted lettuce when there was a deficiency of phosphorus or nitrogen; a deficiency of nitrogen, however, resulted in a light green lettuce of a characteristic and abnormally regular and smooth appearance. Lack of calcium with May King did not cause deficiency symptoms other than that of decreased yield. A deficiency symptom noted with magnesium was a tendency to an etiolated plant and to a bleached whitish pink appearance of the older leaves. Yields and other data have been examined statistically. [Author's summary.]

1058. PARKER, M. M. 635.53 : 631.84

The effect of large applications of nitrogen on the growth of celery.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 697-701.

Under highly intensive cultural conditions in eastern Virginia two tons of a 6-6-5 fertilizer per acre was insufficient to produce maximum growth and optimum foliage colour of celery spaced 6×10 inches. A supplementary treatment of 300 lb. nitrogen applied in 6 applications at weekly intervals in the irrigation water proved effective.

1059. WALTON, C. L. 635.561 : 632.77

A note on the caddis-fly, *Limnophilus lunatus* Curtis, as a pest of cultivated watercress.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 77-8.

Damage done to watercress beds by the caddis fly larvae consisted of wide destruction of foliage to form the larval dwelling case, and of both foliage and stems as food. In addition large numbers of water snails were present round the roots. The snails were killed by very dilute solutions of copper sulphate, and the larvae by a derris solution, the concentration aimed at being 0.001%.

1060. BURRELL, P. C., AND WHITAKER, T. W. 577.15.04 : 635.611

The effect of indol-acetic acid on fruit-setting in musk-melons.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 829-30, bibl. 2.

From these experiments at La Jolla, Calif., it appears that growth substance such as indol-acetic acid can be advantageously used, at least in melon breeding, to reduce the abscission of pollinated flowers.

1061. SCHROEDER, R. A. 635.63 : 581.144.2 : 551.52

The effect of root temperature upon the absorption of water by the cucumber.

Res. Bull. Mo. agric. Exp. Stat. **309**, 1939, pp. 27, bibl. 6.

Leaf and fruit injury of cucumbers grown in Missouri is caused by a deficiency of water due to excessive transpiration. The degree of injury varies with the condition of the plants, the injury being the more severe the more vigorous the plants and the more rapid the temperature change. 70° F. or slightly higher appears to be the most practical soil temperature for cucumbers in Missouri. Watering with cold water may lower the soil temperature sufficiently to induce typical leaf and fruit injury.

1062. LITVINOV, L. S., AND LUKIANOV, N. I. 581.143.26.03 : 635.63/64

Vernalization of tomatoes and cucumbers. [Russian, English summary 48 lines.]

Publ. (Zhbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 207-28, bibl. 20.

Vernalization experiments in 1935-6 at Lipovaya Gora with tomatoes and near Sverdlovsk with cucumbers are here described. Germinating tomato seed (varieties Bison and Sparks Earliana)

subjected to temperature and light treatments gave both increased yields and earlier ripening. The two varieties required temperatures of 6°-8° C. and 18°-20° C. for 7 to 10 days. In order to pass through the light stage, they required short daylight conditions (10-hour day) and somewhat higher temperatures than those needed for vernalization. These vernalization conditions present no difficulties in practical application. Cucumbers passed through the vernalization stage at 10° C. for approximately 5 days. Vernalization requirements of two other varieties were similar and resulted in 20% yield increase. If in addition the seed was subjected to 12-hour day, yields were increased by 30% and by 48%. Higher yields could also be obtained by exposure to higher vernalization temperatures (20-25° C.).

1063. FEDOROV, D. A. 635.63/4 : 631.544

Acetate films in place of glass in commercial production of cucumbers and tomatoes. [Russian.]

Proc. Lenin Acad. agric. Sci., Moscow, 1940, No. 5, pp. 13-6.

In preliminary trials in 1938 acetate films gave a 60% increase in yields of the Nerosimye cucumbers over controls cultivated in open beds. In 1939 comparative trials were made of acetate films and glass frames. Both cucumbers and several varieties of tomatoes were used. The results obtained with cucumbers seem to be of little value as the conditions were in no way uniform. In trials with tomatoes acetate films gave highly increased yields of ripe fruits (67.6% by weight and 43.0% by number). Unlike the experience with cucumbers there was only a slight increase in early pickings (30%) due to the stimulating effect of acetate films but the effect was most marked during later pickings (116% increase). The good effect of acetate films on growth and productiveness of both crops is ascribed to improved microclimatic conditions and especially as regards light and action of soil bacteria.

1064. (i) HARRINGTON, J. F. 635.64 : 631.4

Relation of soil pore space to growth and yield of tomatoes.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 919-22.

(ii) CRANDALL, F. K., AND ODLAND, T. E. 635.64 : 631.8

The response of tomatoes to fertilizer ingredients.

Ibidem, 37 : 923-6, bibl. 2.

(iii) HOFFMAN, I. C. 635.64 : 631.8

The effect of the size of the fertilizer application on yield of greenhouse tomatoes.

Ibidem, 37 : 927-9.

(iv) HAWTHORN, L. R. 635.64 : 631.542

Pruning unstaked tomatoes.

Ibidem, 37 : 930-4, bibl. 3.

(v) HESTER, J. B. 635.64 : 631.8

New methods of fertilizing tomatoes.

Ibidem, 37 : 935-8, bibl. 6.

(vi) HOWARD, F. L., AND CRANDALL, F. K. 635.64 : 632.944

Response of field grown tomatoes to soil fumigation with chloropierin.

Ibidem, 37 : 939-41, bibl. 2.

(i) By pore space is meant the total volume of soil sample not occupied by the soil. Experiments at Columbus, Ohio, have been directed to determine how pore space is affected by different treatments and what the joint effect on yield of tomatoes is. In general yields are high or low following the different manurial treatments according as the pore space is high or low, but other factors such as the water-holding capacity of the soil are found also to be important.

(ii) Tests in which variations were made in amount of manurial additions to tomatoes growing in the open at Kingston, Rhode Island, indicate that a fertilizer containing 5% N, 8-10% P₂O₅ and from 4 to 6% K₂O should be successful under Rhode Island conditions.

(iii) Experiments at Wooster showed that the present high rates of fertilizer application to greenhouse tomatoes cannot profitably be exceeded. They are per acre, approx. 1,000 lb. 20% superphosphate and 750 lb. 50% muriate of potash, 50-60 tons of manure and 250 lb. nitrogen in the form of calcium and potassium nitrate.

(iv) Trials at Winter Haven, Texas, on tomatoes grown in the open resulted in increased acre yields from closely planting tomatoes and pruning to one or two stems. Total marketable

yields over the whole season are actually reduced, but the early pickings are greatly increased and this makes for profit.

(v) The author's studies at Riverton, N. Jersey, in 1938 and 1939 lead him to conclude that field tomatoes should receive liberal applications of phosphatic fertilizer in the row under the plant before or at planting time. As regards N and K he considers that these should be used as a side dressing on sandy soils and broadcast and ploughed in on heavy soils.

(vi) Soil fumigation with chloropicrin was tried on tomato soils at the Rhode Island Experiment Station, Kingston, where despite high fertilizer level and otherwise good cultural practice yields were low. Results of 3 seasons' trials were excellent, increases in yield amounting to 46%, 378% and 246% respectively. This success indicates that the limiting factors are injurious competing and pathogenic soil organisms.

1065. LITVINOV, L. S. 635.65

On the causes of the inhibiting effect of tomato juice on the germination of tomato seed. [Russian, English summary 16 lines.]

Bull. Inst. Rech. biol. Perm, 1938, 11 : 163-71, bibl. 6.

The primary cause of the inhibiting action of tomato juice on germination of tomato seed was found to be the osmotic pressure of the juice and not, as Oppenheim supposed, specific organic substances in the juice. Substances that can be destroyed by heat cause under certain conditions only slight inhibition of the germination process. The inhibiting action on the process of seed germination is not a specific characteristic of tomato juice but is common to all fruit juices.

1066. BAUSOR, S. C. 635.64 : 577.15.04

Response of tomato plants to β -naphthoxyacetic acid.

Amer. J. Bot., 1939, 26 : 733-6, bibl. 4.

The growth response in intact tomato plants to β -naphthoxyacetic acid in concentrations of from 1.0 to 0.01% is discussed.

1067. HOWLETT, F. S. 577.15.04 : 635.64

Experiments concerning the practicability of certain chemicals as a means of inducing fruit setting in the tomato.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 886-90.

The most effective substance for producing increased fruit set of fruit equal in size to normal tomatoes was indolebutyric acid 0.5% in lanum paste. The comparative effects of this and of indoleacetic, K indoleacetate and K naphthaleneacetate are noted and discussed.

1068. KOLODNY, L., AND ROBBINS, W. R. 635.64 : 631.83

Availability of fixed potassium to plants.

Soil Sci., 1940, 49 : 303-12, bibl. 22.

Tomato plants were grown in sand cultures to study the availability of fixed potassium as compared with exchangeable potassium and to compare the availability of these sources of potassium with that present in untreated bentonite and as a constituent of a complete nutrient solution. Fixed potassium consisted of that potassium undisplaceable by calcium ions after the alternate wetting and drying of potassium-saturated Wyoming bentonite by the methods described. Exchangeable potassium was prepared by saturation of the untreated bentonite with potassium by the usual methods. The following is a summary of the more important results:—Fixed potassium was utilizable by tomato plants to but a slight extent for growth. Fixed potassium was not nearly so readily available to tomato plants as was exchangeable potassium or the potassium of untreated bentonite. Fixed potassium became available to the tomato plants to a slight extent apparently by means of root action, perhaps either by carbonic acid excretion or by means of direct contact exchange between roots and the bentonite sample containing this form of potassium. [Authors' summary.] The work was carried out at the New Jersey Agricultural Experiment Station.

1069. WALL, M. E. 635.64 : 631.83
The role of potassium in plants : II.* Effect of varying amounts of potassium on the growth status and metabolism of tomato plants.
Soil Sci., 1940, 49 : 315-31, bibl. 16.

Rutgers tomatoes grown in solutions containing various amounts of potassium showed a deficiency in all containing less than 45 p.p.m. Growth data curves increased with increments in potassium supply up to 45 p.p.m. but thereafter slowly declined. The first stage of potassium deficiency was marked by a stunted, hard, yellow plant and was associated with a high carbohydrate content in a low potassium plant. In the second stage the carbohydrate content diminished, the plants turned green and soft and began to grow, while the lower leaves began to die progressively up the stem. The potassium-deficient plants were characterized by a much higher soluble organic nitrogen and total nitrogen content than the plants receiving the complete solutions. The initial carbohydrate accumulation and final decrease, and the high soluble organic nitrogen content were most noticeable in the completely potassium-deficient plants. As more potassium was supplied, the plants in the various series approached closer and closer to normal plants in carbohydrate and nitrogen concentrations. The potassium content of the plants slowly increased with increasing potassium up to 22 p.p.m. At this point increments of 45 p.p.m. and 175 p.p.m. of potassium caused sharp increases in the potassium content. Calcium magnesium and phosphates were generally higher in concentration in the low potassium plants. [From author's summary.]

1070. WALL, M. E. 635.64 : 631.83
The role of potassium in plants : III.* Nitrogen and carbohydrate metabolism in potassium-deficient plants supplied with either nitrate or ammonium nitrogen.
Soil Sci., 1940, 49 : 393-408, bibl. 20.

Young Rutgers tomato seedlings were grown in nutrient solutions containing nitrate and ammonium nitrogen with and without potassium. The nitrate plants made the better growth. Potassium-deficient plants grown with nitrate showed typical deficiency symptoms; potassium-deficient plants grown with ammonium suddenly developed leaf breakdown symptoms of a totally different nature, causing rapid death of the leaves from toxic effect of high internal ammonium concentrations. In both series the potassium-deficient plants accumulated ammonia, amide and amino nitrogen while the protein concentration decreased. An initial carbohydrate accumulation was shown which finally decreased and fell to lower values than in plants supplied with complete potassium. The evidence indicates that protein synthesis from an elaborated form of nitrogen is affected by potassium deficiency and this would account satisfactorily for the phenomena already mentioned. The analytical data point strongly to the fact that the nitrogen metabolism is affected by potassium deficiency prior to the carbohydrate metabolism. The final drop in carbohydrate content of potassium-deficient plants may be due to a direct need for potassium in CO₂ assimilation or to the indirect effects on protoplasm brought about by the interference with the nitrogenous metabolism of potassium-deficient plants. [From author's summary.] The work was carried out at the New Jersey Agricultural Experiment Station.

1071. SAYRE, C. B., KERTESZ, Z. I., AND LOCONTI, J. D. 635.64-1.8 : 664.84.64
The effect of calcium and potassium fertilizers on the solidity and the calcium and potassium content of canned tomatoes.
J. Amer. Soc. Agron., 1940, 32 : 389-94, bibl. 5.

Special treatment of tomatoes with soluble calcium salts during processing can greatly increase the firmness of the canned product. These experiments were aimed at determining whether additions to the soil might have the same effect. The authors reach the following conclusions:—On a soil in which calcium is naturally abundantly supplied and in which potassium is not adequately supplied for maximum crop yields, the addition of calcium salts or potassium salts as soil amendments in the amounts used in this experiment had no appreciable effect on the calcium or potassium content of tomatoes grown in the soil, nor on the firmness of the canned tomatoes as measured by the drained weight.

* Part I. Effect of varying amounts of potassium on nitrogenous, carbohydrate and mineral metabolism in the tomato plant. *Ibidem*, 1939, 47 : 143-61; *H.A.*, 9 : 1290.

1072. HARTMAN, J. D., AND STAIR, E. C. 635.64 : 631.564 : 668.21

The use of glycerine in shipping tomato plants.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 916-8, bibl. 1.

Tests were made in Georgia and Indiana of the effect of adding glycerine (water and 0.1% glycerine) to the peat in which the roots of tomato plants were packed for transport. Glycerine resulted in no significant increase in yield, nor in any injurious effect except in slightly delayed maturity. The nature of the effect is unknown, but appears to be physiological.

1073. YOUNG, P. A., HARRISON, A. L., AND ALTSTATT, G. E. 635.64 : 632.3/4 + 632.8

Common diseases of tomatoes.

Circ. Tex. agric. Exp. Stat. 86, 1940, pp. 32.

The more important root, stem, leaf and fruit diseases of tomatoes in Texas are described with the aid of photographs, and control measures against them are suggested. A key to common field diseases of tomatoes is attached.

1074. CHAMBERLAIN, E. E., BRIEN, R. M., DALLAS, W. K., AND TAYLOR, E. T. 635.64 : 632.48

Experiments on the control of tomato leaf-mould.

Orchard. N.Z., 1940, 13 : 58-61, bibl. 2.

After 3 years' experiments with therapeutants none was found able to control completely tomato leaf-mould (*Cladosporium fulvum*). Substances which proved effective enough to warrant their use were Shirilan A.G. at a concentration of 0.3%, lime-sulphur + agram, lime-sulphur + colloidal sulphur, lime-sulphur. Sublimed ground and colloidal sulphur, gas sulphur spray and dust were inefficient. Gas sulphur alone caused foliage injury.

1075. BONNEMAISON, L. 635.64 : 632.8

La maladie bronzée de la tomate. (Tomato spotted wilt.)

Ann. Épiphyt. Phytogén., 1940, 5 : 268-308, bibl. 95.

An account of investigations made in the Bordeaux district in 1936 and 1937 and in 1938 at Lyons on tomato spotted wilt. The nature of the virus and its method of transmission are discussed as also the morphology of *Thrips tabaci*, a vector of the disease.

1076. HOWARD, A. 635.64 : 632.48

Sleeping disease of tomatoes.

Gdnrs' Chron., 1940, 107 : 260.

In Guernsey and in Hampshire tomatoes affected by sleeping disease (*Verticillium*) have made complete recovery when transplanted to soil rich in humus from the compost heap.

1077. WHITE, H. L. 635.652 : 612.014.44

The effect of reduced day length on beans grown under glass.

Twenty-fifth A. R. exp. Res. Stat. Cheshunt 1939, 1940, pp. 48-9.

Experiments under glass of restricting the daylight to beans grown in pots resulted as follows :—Ne Plus Ultra, a variety unsuitable for forcing, produced no pods under any treatment given. Canadian Wonder gave a crop increase of 71% when daylight was reduced by 2 hours below 11.3 hours and the same crop weight as under ordinary daylight if submitted to a 4-hour reduction. Tender and True gave the same crop under normal light conditions and under conditions of 2-hour reduction per day. Under 4-hour reduction conditions the yield was decreased by 34% mainly owing to the small number of pods produced.

1078. BURLISON, W. L., VAN DOREN, C. A., AND HACKLEMAN, J. C. 635.655

Eleven years of soybean investigations.

Bull. Ill. agric. Exp. Stat. 462, 1940, pp. 123-67.

The paper deals with variety trials, performance, seeding practices and their effects on yield, and with storage. Some general recommendations are made and there is an appendix in which the characteristics of 66 varieties and strains are tabulated.

1079. SEARS, O. H. 635.655 : 631.459

Soybeans : their effect on soil productivity.

Bull. Ill. agric. Exp. Stat. 456, 1939, pp. 547-71, bibl. 11.

On rolling land soybeans drilled in single rows at cornplanter width up and down the slope cause serious erosion. When "drilled solid", i.e. 8 inches apart on the contour, and followed after harvest by a cover crop of small grain, erosion is very greatly reduced. Thus a variety maturing sufficiently early to permit of wheat being sown at the normal time is very desirable. Soybeans deplete the soil of nitrogen unless part of their tops is returned to the soil. Available phosphorus and potash is often too low for wheat following a soybean crop and these fertilizers should therefore be supplied. Potash used alone has seldom increased the wheat crop. If winter grain is not necessary to check erosion better results following soybeans are obtained by spring sown crops, since by that time the physical, chemical and biological forces have time to replenish the supply of available soil nutrients.

1080. MINARIK, C. E., AND SHIVE, J. W. 635.655 : 546.27 : 581.192

The effect of boron in the substrate on calcium accumulation by soybean plants.

Amer. J. Bot., 1939, 26 : 827-31, bibl. 15.

Experiments by the Plant Physiology Department, N. Jersey Agricultural Experiment Station, show that the production of new tissue by soybean, as also the percentage of calcium in the leaves, is conditioned by the concentration of boron in the nutrient solution. The optimum range of boron concentration in the substrate lies approx. between 0.025 p.p.m. and 1.0 p.p.m. The calcium content of the ash is influenced by the boron content of the substrate, both excess and deficiency of boron corresponding with low percentage value for calcium in the ash.

1081. CASTELLI, T. 635.655 : 631.531.17 : 631.847.2

Ulteriori ricerche sulla produzione dei tubercoli radicali della soja. (Further investigations in the production of root tubercles in soya.)

Ital. agric., 1940, 77 : 253-61.

With results of experiments to prove his point the author urges strongly that all intending to sow soya bean should, prior to sowing, either have the seed treated with the proper strain of *Bacillus radicicola* or failing that with soil in which soya has previously been grown, in order to ensure maximum growth and seed production, and in addition benefit to the soil.

1082. JONES, H. A., AND WADE, B. L. 635.656 : 631.847

Inoculation studies with the garden pea in California.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 718-24.

Inoculation of pea seed with nitrogen-forming bacteria prior to planting at Davis, California, did not result in an increase in yield of seed or straw over the control.

1083. JOHNSON, F. 635.656 : 632.8

Viroses of the garden pea (*Pisum sativum* L.) in Washington.

Res. Stud. St. Coll. Wash., 1939, 7 : 155-6, bibl. 3.

Three virus diseases cause sufficient damage to market peas in Washington State to cause a severe decrease in production on account of the cost of combating them. They are known as (1) enation, (2) streak and (3) severe mottling. (1) and (3) were successfully transmitted artificially by aphides and also easily by mechanical means. (2) was not transmitted artificially by aphides and only with difficulty mechanically. The origin of the viruses in the field in early spring could not be traced. There were indications later that vetch grown as hay may be a source of mosaic *via* the common aphid and that pea nodule bacteria may act as overwintering hosts. No immune varieties were found out of 488 pea strains tested, but 2 showed a constant degree of resistance and 8 matured early enough to escape the most severe damage from aphids and mosaic. Possible control lies in the eradication of aphides in early spring, destruction of leguminous plants susceptible to pea mosaic and selection of resistant varieties.

1084. OGILVIE, L., CROXALL, H. E., AND HICKMAN, C. J. 635.656 : 632.952.2

Cuprous oxide as a seed protectant for peas.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 88-99, bibl. 18.

A review is given of previous literature dealing with pre-emergence damping-off of peas and its control by cuprous oxide. Greenhouse and field experiments showed that an increased emergence

of seedlings under certain environmental conditions may be obtained by treating the seeds with cuprous oxide. Cuprous oxide compared favourably with organo-mercury seed dressings as a seed protectant for peas. Evidence is presented that cuprous oxide may retard the rate of seedling emergence and in dry soils may cause injury to certain varieties. [Authors' summary.]

1085. MONRO LTD., G. 635.8

Mushroom production from pure-culture spawn.

Geo. Monro Ltd., Waltham Cross, pp. 68, 2s. 6d.

A practical, well-illustrated handbook on modern mushroom culture.

1086. PILE, A. 633.491

La culture de la pomme de terre en Tunisie. (Potato growing in Tunisia.)

Tunisie agric., 1939, 40 : 185-205.

DUCOMET, V., AND FOEX, E. 633.491-2.411

Les attaques de *Phytophthora infestans* (Mont.) de Bary pendant la période 1919-1937. (The attacks of potato blight during the period 1919-1937.)

Ann. Epiphyt. Phytogén., 1939, 5 : 17-9.

LIMASSET, P. 633.491-2.411

Recherches sur le biologie du *Phytophthora infestans* (Mont.) de Bary. (Investigations on the biology of *P. infestans*.)

Ibidem, 1939, 5 : 21-39, bibl. 46.

MARSH, P. B., AND GODDARD, D. R. 635.13 : 581.11/12

Respiration and fermentation in the carrot, *Daucus Carota*. I. Respiration.

II. Fermentation and the Pasteur effect.

Amer. J. Bot., 1939, 26 : 724-8, bibl. 16, and 767-72, bibl. 23.

ROLAND, G. 635.11 : 632.19 : 581.192

Onderzoekingen verricht in 1938 over de vergelingsziekte, de zwarte vlekken, de vorming van anthocyaan en de ontleding van zetmeel bij de biet. (Investigations made in 1938 on the chlorosis, black spot disease, formation of anthocyanin and the starch content in beetroot.) [French summary 2 pp.]

Reprinted from *Tijdschr. Plziekt.*, 1939, 45 : 181-203, bibl. 44.

Dutch experiments on beetroot.

STIRRUP, H. H. 633.63-2.19 : 546.27

Heart rot in sugar beet.

Reprinted from *Brit. Sug. Beet Rev.*, July 1939, pp. 4.

STEINBAUER, C. E. 635.24

Physiological studies of Jerusalem artichoke tubers with special reference to the rest period.

Tech. Bull. U.S. Dep. Agric. 657, 1939, pp. 52, bibl. 67, 15 cents.

BELOZERSKY, A. N. 635.25 : 581.192

Nucleic acids of *Allium Cepa* bulb.

C.R. Acad. Sci. U.R.S.S., 1939, 25 : 751-2, bibl. 2.

JOHNSON, L. R. 635.48 : 632.651.3

Further observations on *Anguillulina dipsaci* in rhubarb.

Ann. appl. Biol., 1939, 26 : 739-49, bibl. 11.

LLOYD, J. W., AND BURLISON, W. L. 635.655

Eighteen varieties of edible soybeans : their adaptability, acceptability, culture and characteristics.

Bull. Ill. agric. Exp. Stat. 453, 1939, pp. 385-438.

HAMNER, C. L. 635.655 : 631.8

Growth responses of biloxi soybeans to variation in relative concentrations of phosphate and nitrate in the nutrient solution.

Bot. Gaz., 1940, 101 : 637-49, bibl. 8, being *Contr. Hull. bot. Lab.* 510.

- SMITH, K. M., AND DENNIS, R. W. G. 633.491-2.8
Some notes on a suspected variant of *Solanum virus 2* (potato virus y).
Ann. appl. Biol., 1940, **27**: 65-70, bibl. 3.
- AINSWORTH, G. C. 632.8
The identification of certain viruses found infecting leguminous plants in Great Britain.
Ann. appl. Biol., 1940, **27**: 218-26, bibl. 32.
- WATSON, M. A., AND ROBERTS, F. M. 632.8
Evidence against the hypothesis that certain plant viruses are transmitted mechanically by aphides.
Ann. appl. Biol., 1940, **27**: 227-33, bibl. 9.
- CUNNINGHAM, C. R. 635.615
Fruit setting of water melons.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37**: 811-4, bibl. 4.
- DONEEN, L. D., PORTER, D. R., AND MACGILLIVRAY, J. H. 635.615
Irrigation studies with watermelons.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37**: 821-4, bibl. 7.
- HIBBARD, A. D. 635.615
Fruit thinning the watermelons.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37**: 825-6, bibl. 1.
1087. ANON. 633.71
Tobacco soils and fertilizers.
Publ. Dep. Agric. Canada **703**, 1940, pp. 4 (being *circ.* 167).
 ANON. 633.71
Tobacco types and varieties.
Publ. Dep. Agric. Canada **704**, 1940, pp. 4 (being *circ.* 168).
- In the first of these articles the soil and fertilizer requirements of flue cured, burley, dark, cigar and pipe tobacco in Canada are discussed, in the second the characters of different varieties in these groups.
1088. THUNG, T. H. 633.71-2.8
 Smetstof en plantencel bij enkele virusziekten van de tabaksplant V. (**Infective principle and plant cell in some virus diseases of the tobacco plant V.**) [English summary 2 pp.]
 Reprinted from *Tijdschr. PlZiekt.*, 1939, **45**: 247-59, bibl. 12.
- A study at Klaten (Java) of antagonistic activities of different tobacco viruses. The chief results are set out in an English summary.
1089. BORTNER, C. E., AND KARRAKER, P. E. 633.71-2.19
Studies of frencing of tobacco with particular reference to thallium toxicity.
J. Amer. Soc. Agron., 1940, **32**: 195-203, bibl. 8.
- Studies at Kentucky Agricultural Experiment Station have shown that frenching of tobacco is related to the lime content of the soil and to the soil nutrient supply. Additions of small amounts, 0.04 p.p.m., of thallium to tobacco grown in water cultures and larger amounts in sand cultures produced chlorosis but all were unlike frenching in several respects. In soil cultures very much larger amounts of thallium (7.15-28 p.p.m.) were required and even then did not always produce chlorosis. Liming and low nutrient content did not increase thallium chlorosis whereas these conditions do produce frenching. A much greater amount of thallium is required to produce chlorosis in soil cultures than is ever likely to be present in soils where frenching occurs.
1090. HOERNER, G. R., AND RABAK, R. 633.79
Production of hops.
Emrs' Bull. U.S. Dep. Agric. **1842**, 1940, pp. 40.
- The bulletin describes the cultivation and preparation and general marketing methods of hops in U.S.A.

1091. THOMAS, W. S. 633.79
The hops of 1939. Growth and cultivation of hops.
J. Inst. Brewing, 1940, **46** : 170-1.

In recent years the use of farmyard manure for hops has been supplanted, and for the better, by a complete dressing of artificials, humus being supplied by the ploughing in of the chickweed always present in well farmed gardens. The cost of picking has risen 100%. Oasthouses are now buildings full of expensive machinery entailing heavy capital outlay, but the product has greatly improved. Now there is a greater retention of essential oils and resins owing to low temperatures (140° F. maximum) and high air speeds of drying. Attempts to persuade growers to postpone picking to ripen the hops more thoroughly only resulted in more bushels being required per cwt., the reason being in doubt.

1092. KUHLMANN, G. W., AND FORE, R. E. 633.79
Cost and efficiency in producing hops in Oregon.
Stat. Bull. Ore. agric. Exp. Stat. **364**, 1939, pp. 57.

The average cost of producing hops in Oregon during a 3-year study was 18.6 cents per pound, and the average yield was 889 pounds of dried hops per acre. In two good hop years the yield was 973 and 989 pounds respectively and producing cost approximately 17 cents per pound each year. In a poor hop year the yield was 706 pounds and average cost 21.9 cents. The chief costs of production were (1) man labour, 57.1%; (2) materials, equipment operation and general expense 23%; and (3) interest and depreciation on the hop investment, 18.7%. All other costs amounted to only 1.2%. Per acre yield was an important factor in determining production cost. Medium sized hop yards appeared to have the lowest cost of production.

1093. BEARD, F. H. 633.79
The effect of various cultural treatments on the cropping of hops.
A. R. East Malling Res. Stat. for 1939, **A23**, 1940, pp. 76-8, bibl. 5.

A discussion of various cultural treatments on the growth and yield of hops at East Malling. Most of the varieties under trial are Salmon's new introductions. Work to date indicates that distance between hills greatly affects yield, but the number of bines per string has much less effect. Both factors influence cone development. So far pulling and cutting treatments which vary the vigour of the trained bine have had no effect on yield. The methods of "stopping" tested have prevented the formation of "heads" but have also reduced the crop. Future trials will be made on stopping technique, effect of number of strings per hill and irrigation.

1094. HOLUBINSKY, I. N., AND HOLUBINSKAYA, N. I. 633.79-1.523
Effect of heat upon the mutation rate in hop (*Humulus lupulus* L.).
C.R. Acad. Sci. U.R.S.S., 1939, **25** : 773-6, bibl. 16.

A study of the effect of varied temperature and humidity on the behaviour of hop plants from homogeneous seed.

1095. POLLACCI, G., GALLOTTI, M., AND FELLAGARA, C. 633.88.115
Sulla *Digitalis lanata* Ehrh. pianta medicinale italiana. (*Digitalis lanata*, an Italian medicinal plant.)
Att. Ist. bot. Univ. Pavia, 1939, **11** : 3-12, bibl. 14.
 MARANGONI, P. 633.88.115
Attività della *Digitalis lanata* Ehrh. coltivata in Pavia. Influenza delle radiazioni solari e delle modalità di preparazione della polvere. (The medicinal activity of *D. lanata* grown at Pavia. The effect of solar radiation and of method of preparing the powder.)
Ibidem, 1939, **11** : 113-23, bibl. 12.

Digitalis lanata will grow without difficulty at Pavia and with a content of glucoside nearly equal to that obtained in its country of origin, Hungary. 2.2-2.3 g. glucoside can be expected from each kilogramme of fresh material. The species is preferable to *D. purpurea* because (1) the active principle contained is much more stable, (2) its therapeutic and chemical properties are superior, (3) it has a higher content of active principles, and (4) its glucosides are 3 or 4 times more active than those of *D. purpurea*. In the second article figures are given showing the great

superiority of *D. lanata* to *D. purpurea* as a source of the drug. It is noted that growing on a southward facing site results in considerably greater content of the active principle than growing in more shaded positions. The presence of the venation does not increase the activity of the dust extracted. In the case of *D. lanata* there is no need for practising complete pulverization as in the case of *D. purpurea*, since in the former the presence or absence of the venation would not appear to affect the activity of the drug.

1096. ZAGORODNY, G. P., AND KHARITONOVA, S. M. 633.85

Growing *Xanthium Strumarium* for oil. [Russian.]

Proc. Daghestan agric. Inst. Makhach-Kala, 1939, No. 1, pp. 270-6, bibl. 11.

This weed belonging to the *Compositae* promises to be a valuable oil plant, provided commercial methods are found for extraction of oil from its rather hard-husked seed. The fine properties of the oil and exceptionally high yields per acre of the raw product, which contains not only oil but also 45% protein, are particularly welcome features of this future plantation crop.

1097. UKRAINSKY, V. T. 633.85

Crop rotation in the zones of cultivation of oil plants. [Russian.]

Sovetsk. Agron., 1940, No. 4, pp. 14-23, bibl. 7.

On the basis of experience till 1939 suggestions for crop rotations are made for six different oil plant areas, namely in the (1) arid and semi-arid steppe with irregular rainfall, (2) semi-arid steppe with irregular rainfall, (3) arid steppe with irregular rainfall, (4) woody steppe with the common heavy non-alkaline black soils, (5) areas having short summer periods and subject to severe winter conditions and (6) areas with a fair amount of rainfall and mild winter conditions.

1098. VAKULIN, D. YA. 633.85

Tests of *Eruca sativa* Lam in Odessa. [Russian, English summary 6 lines.]

J. Inst. bot. Kiev, 1938, Nos. 18-19 (26-27), pp. 231-7, bibl. 9.

The growth is here described of *Eruca sativa* plants under Odessa conditions from seed obtained from various sources in U.S.S.R. and elsewhere. The times of germination, flowering, ripening, height and shape of the oil plants are recorded and the periods from germination to flowering and to maturity noted together with seed size and seed and oil yields per plant.

1099. MALIVAİKO, YU. S. 635.24 : 631.432

The effect of soil moisture on the growth of *Helianthus tuberosus*.

[Ukrainian, Russian and English summaries.]

J. Inst. Bot. Kiev, 1938, No. 17 (25), pp. 197-203, bibl. 10.

Pot and field experiments with Jerusalem artichoke, *Helianthus tuberosus*, were carried on at Zhitomir (Ukraine) for three years. Of the different soil humidities the plant showed a decisive preference for 80% of complete saturation. At this soil moisture the above ground parts of the plant grew most vigorously and the yields of tubers were the highest both numerically and by weight.

1100. MOVCHAN, S. D. 633.94 : 581.192

On the resins contained in *Euphorbia Lathyris* L. [Russian, English summary 12 lines.]

Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 315-28, bibl. 24.

There was no significant difference in resin content between caper spurge plants from Daghestan and Ukraine. Most of the resins were contained in the leaves. Seasonal dynamics of resins were not uniform for the different parts of the plant. The total amount of resins declined as the plants matured. The ratios of resins soluble in different organic solvents changed during the growth season. Stearins present in resins are thought to be identical with the stearins of the oil of the same plant, which are used in medicine. *Euphorbia* resins have toxic properties.

1101. KISELEV, I. S. 633.853.55 : 581.13

Seasonal accumulation of nutrients in *Ricinus communis*. [Russian.]

Proc. Lenin Acad. agric. Sci., Moscow, 1940, No. 4, pp. 35-6.

Experiments made in 1937 by the VNIIMK (U.S.S.R. scientific research Institute of oil cultures) with two varieties of castor oil plant led to the following conclusions:—The intake of nutrients

by the castor oil plants increased towards the end of the growing season. A crop of 16 centners seed and 27.5 centners green material per ha. removed from the soil some 100 kg. nitrogen, 84 kg. potash, and 22 kg. phosphorus. Late applications of nitrogen and phosphorus gave better results than early applications.

1102. LISITSYN, D. I. 633.854.54 : 581.192

The dynamics of nitrogenous substances and proteolytic enzymes in the leaves of sunflower prior to and after wilting. [Russian, French summary 11 lines.]

Bull. Soc. Nat. Moscow, 1938, 47 : 158-64, bibl. 16.

Wilting of the sunflower results in a sharp increase in active proteases and a decrease in protein which undergoes a partial disintegration. On establishing normal water supplies these characteristics gradually disappear. Subjecting the sunflower periodically to low temperatures does not bring about appreciable changes in either nitrogenous compounds or activity of proteolytic enzymes. This indicates that the sunflower is incapable of acquiring improved hardiness.

1103. ANTONIANI, C. 633.527.5

Note e considerazioni sull'industria della ginestra. (Broom fibre extraction and its commercial possibilities.)

Ital. agric., 1940, 77 : 189-97.

A note on the commercial possibilities of broom fibre extraction. The actual technical processes are not described, but the possible use of the by-products is discussed. For a full account of the cultivation of the broom plant for fibre making and the processing of its fibres the reader is referred to Trotter's article in the same journal 1936, Vol. 73, pp. 181-92.

1104. BOTVINOSKY, V. V. 633.522 : 581.1

Contribution to the physiology of hemp development. [Russian, English summary 37 lines.]

Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 155-62, bibl. 15.

In experiments with hemp at Zhitomir (Ukraine) correlation of the length of day and night was found to be of paramount importance for (a) the transition from the vegetative to the flowering stage and the reverse transition ; (b) the rate at which these stages proceed.

1105. KRUZHALIN, A. S., SAMOILOV, V. I., AND SHESTIALTYNOV, M. S. 633.85 : 581.1 : 631.587

Irrigation as affecting changes in carbohydrates, nitrogenous compounds and fats in sunflower. [Russian, English summary 28 lines.]

Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 297-308, bibl. 18.

FLOWER GROWING.

1106. LAURIE, A., AND POESCH, G. H. 635.9 : 677.61 : 631.544

Cloth houses.

Commercial flower forcing, Blakiston, Philadelphia, 2nd ed., 1939, pp. 504-19, bibl. 18.

The advantages of the cloth house for the summer culture of flowers of superior quality for sale are :—lessened chance of disease infection or insect attack and improved quality of blooms. through the partial control of light intensity, humidity and temperature, shelter from wind, rain and mud splash, and prolongation of keeping qualities through lack of insect or wind pollination. Investigations on light intensity under cloth show a marked reduction, the intensity being greater under yellow than under white cloth. The increased stem length and size of plants may be due to reduced light conditions. The temperature under cloth was about 8° F. less than outside between 2 and 5 p.m. and had a time lag of $\frac{1}{2}$ -1 $\frac{1}{2}$ hours. The relative humidity differs little from outside (2.2 greater in July) but the reduced air circulation greatly reduced transpiration. As regards watering three times less water was required under cloth and the uniformity of soil moisture obtained under cloth was another important favourable factor. The cloth recommended has a mesh of 22×22 threads per sq. inch. The colour should preferably be yellow or white (in any case other colours usually fade). The width of the cloth is 33 ft. 4 in.,

and a width of 33 ft. or a multiple is recommended for the house. The material is stitched on side and cross wires strained on posts set in cement or well guyed. Further details of construction are given very fully. Many kinds of plant can be grown including asters, roses, pompon chrysanthemums, sweet pea, etc.

1107. SKINNER, H. T. 577.15.04 : 635.939.124
Further observations on the propagation of rhododendrons and azaleas by stem and leaf-bud cuttings.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1013-8, bibl. 3.

The author describes a continuation of his experiments* with growth substances on the successful propagation of ericaceous plants. Most varieties gave satisfactory response to suitable concentrations of indolebutyric acid. Hormonized dust increased the rate of shoot production and the percentage of growing plants. Liquid indolebutyric acid at 6 mg. per 100 c.c. delayed shoot formation and decreased the number of plants producing vegetative shoots. Rooting of leaf bud cuttings was decreased by waxing the leaves prior to setting. Additional light improved rooting of leaf bud cuttings.

1108. STRUCKMEYER, B. E., AND ROBERTS, R. H. 612.014.44 : 551.52 : 631.535 : 581.14
Effect of photoperiod and temperature upon the growth of seedlings and cuttings.
Amer. J. Bot., 1939, 26 : 694-7, bibl. 5.

Cuttings of *Antirrhinum*, *Centaurea* and *Petunia* were found to respond in a different manner to light and temperature exposure than did seedlings of these genera. The degree of variability within a population of seedlings or of a clone was influenced by environment.

1109. WEISS, F. 632.421.1 : 635.9
Powdery mildew of ornamental plants.
Leaflet. U.S. Dep. Agric. 197, 1940, pp. 4.

The most common mildews on ornamentals are *Erysiphe* spp. Dusting or spraying with some form of sulphur proves an effective control.

1110. LYLE, E. W. 635.937.34 : 632.3/4
Rose diseases.
Circ. Tex. agric. Exp. Stat. 87, 1940, pp. 16.

Descriptions together with the most practical and up-to-date methods for control are here given of the more important leaf, stem and root diseases of roses in Texas. Insect injuries and troubles arising from lack of fertility or soil moisture and other cultural factors are not considered.

1111. MORETTINI, A. 612.014.44 : 635.939.98
 Ulteriori ricerche sulla pratica dell'oscuramento per anticipare la fioritura dei crisantemi. (**Further trials of accelerating flowering in the chrysanthemum by restricting daylight.**)
 Reprinted from *Riv. Soc. tosc. Ort.*, 1939, pp. 9.

The author tried the effect of cutting daylight hours down to 8 daily for a three-week period at different stages in the growth of the chrysanthemum variety Turner. As the result of restricted light even in the first period, i.e. 1-20 June, and the last period, i.e. 2-22 October, the dates of flowering were advanced by 5 days and 7 days respectively, but obviously restricting the light between 2 and 22 August was the most effective and the date of flowering was thereby advanced 24 days. It is suggested that such light restriction might well prove an economical practice.

1112. EMSWELLER, S. L., AND BRIERLEY, P. 635.935.722 : 577.15.04 : 547.944.6
Colchicine-induced tetraploidy in *Lilium*.
J. Hered., 1940, 31 : 223-30, bibl. 8.

The application of colchicine to the stem apex of *Lilium formosanum* resulted in the production of bulblets, most of which were tetraploids. The fertility of these tetraploids varied from plant to plant. The tetraploid flowers varied in size, averaging about 25% larger than diploids.

* See *Ibidem*, 35 : 830 ; *H.A.*, 8 : 934.

1113. HAWKER, L. E. 635.944 : 632.4
Experiments on the control of basal rot of narcissus bulbs caused by *Fusarium bulbigenum* Cke and Mass. with notes on *Botrytis narcissicola* Kleb.
Ann. appl. Biol., 1940, 27 : 205-17, bibl. 14.
 Bulbs stored at temperatures below 27° C. suffered less loss from *Fusarium bulbigenum* but more from *Botrytis narcissicola* infection than those stored at a higher temperature. Rapid drying of bulbs after lifting reduced wastage due to *Fusarium*. The addition of formalin (0.5%) or uspulun (0.25%) to the hot water used for eelworm control reduced subsequent rotting. In addition the use of cold fungicidal steeps and dusts soon after lifting reduced *Fusarium* wastage.
1114. LAWRENCE, W. J. C., AND PRICE, J. R. 581.175.81 : 575
The genetics and chemistry of flower colour variation.
Biol. Rev., 1940, 15 : 35-58, bibl. 75.
 BARNES, H. F. 635.939.98 : 632.771
The biology of the chrysanthemum midge in England.
Ann. appl. Biol., 1940, 27 : 71-91, bibl. 3.
 COCHRAN, F. D., AND VEREEN, T. L. 635.935.722
Some factors affecting flowering and bulb production in the Creole Easter Lily.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 1031-3.

CITRUS AND SUB-TROPICALS.

1115. FENNAH, R. G. 634.3-1.541.11
Observations on behaviour of citrus root-stocks in St. Lucia, Dominica and Montserrat.
Trop. Agriculture, Trin., 1940, 17 : 72-6, bibl. 2.

It is to be noted that these remarks are based on observations made over 3 years on local experiment stations, estates and small holdings and that they serve to show only the need for prolonged observation before a final judgment is reached on the question of the most suitable stock for the islands mentioned in the title.* It is mainly in connexion with their suitability for lime that these stocks are considered. *Seedling lime*.—Good resistance to collar rot even in unsatisfactory environment, fairly high tolerance to root attack by citrus weevil (*Diaprepes* spp.), susceptibility to drought conditions which causes a dieback of the rootlets and subsequently extends upwards into the whole or sections of the tree; this can be delayed by watering or overhead shade but is none the less a very serious disability. *Sour orange*.—This stock is the most generally used. It is satisfactory in certain districts where it is very resistant to gummosis, with higher yields and earlier first bearing by about 2 years than seedling lime. The reputed stronger hold of the roots in the soil compared to seedling lime is not well founded. Resistance to root weevil is not high owing to the scanty main roots produced which can be quickly girdled by only a few weevils. It is greatly influenced by local environment, i.e. according to locality it may develop equally with the scion or be overgrown by it, an effect ascribed to an insufficient water supply to the scion in times of low atmospheric humidity. As a result the following phenomena may occur :—drying out of young fruit, leaf curl and leaf shedding in dry weather, die-back of scion. *Rough lemon*.—Used in Dominica in areas where sour orange has proved unsuitable. It is not resistant to gummosis in wet districts, it is often overgrown by the scion with the same results as sour orange and it has an unsatisfactory field habit. No trees were observed over ten years old. *Gospo or bitter orange*.—Large and well developed trees under these names are common. Little use has been made of the variety as a stock, but such trees as have been budded on it appear to be satisfactory. Root system and degree of tolerance to root weevil equal those of sour orange. More liable to gummosis than rough lemon. *Seville sweet orange*.—A local variety used as a stock in Montserrat. Sufficiently good performance to compete with sour orange and rough lemon in a stock selection trial for ultimate commercial use. Resistant to dry conditions, apparently quite compatible with lime, and fairly tolerant of root

* For an account of the effects, compatibilities and peculiarities of the various citrus stocks throughout the world, see Investigations on the standardization of citrus trees by propagation methods. *Technical Communication 3*, Imperial Bureau of Fruit Production, East Malling, 1932, 2s.

weevil. Susceptibility to gummosis in wet districts is probable. *Rangpur lime*.—The few trees seen by the author on this stock have been unsatisfactory, stunted, with few branches and a poor root system and very susceptible to gummosis. *Wild grapefruit* as distinct from the shaddock or self-sown grapefruit of early commercial varieties. Superior in vigour to all stocks previously mentioned, often even overgrowing the scion and highly resistant to gummosis. Limes on this stock yield better than on sour orange in a sour orange district. Cultivated grapefruit on this stock give consistently good results. On one estate only there seemed to be in a few instances a tendency to impart a completely vertical growth to the scion. *Citron*.—Has proved a complete failure for lime.

1116. SHAMEL, A. D. 634.3

Testing improved citrus strains.

Calif. Citrogr., 1940, 25 : 258-9, 276.

A brief note is given of the origin and outstanding character of twelve improved selected strains of oranges and lemons now under investigation at Riverside Experiment Station, California.

1117. KONSTANTINOV, V. M. 634.3

Attempts to grow citrus in Kisyl-Atrek.

Soviet Subtropics, 1940, No. 4 (68), pp. 18-22.

Despite the favourable climatic conditions citrus cultivation in Kisyl-Atrek on the Caspian Coast presents great difficulties. The author gives an account of his work with various citrus fruits in that area and makes the following suggestions :—Sandy soils lacking humus can be improved by application of manure, mineral fertilizer and gypsum. The tolerance of citrus to soil salinity can be increased by watering the trees with 0.05% acetic acid or acidous extraction from castor oil leaves. Citrus rootstocks have been selected that are not affected by salinity. These are bigaradia No. 02, No. 03, No. 04 and No. 05.

1118. HALMA, F. F. 634.3-1.535-1.541.5

Growth of own-rooted and budded citrus trees.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 279-82, bibl. 2.

Growth records taken at Los Angeles on cross-sectional trunk area of 4 Eureka lemon, 10 Valencia orange, and 6 Navel orange plots, each consisting of different numbers of trees propagated by cuttings and by budding, show that :—Eureka lemon cuttings grew faster than the same clone budded on grapefruit ; Valencia and Navel orange were inconsistent in behaviour, in some cases the cuttings, in others the buddings doing best.

1119. FURR, J. R., TAYLOR, C. A., AND REEVE, J. O. 634.3-1.432

Fruit set of citrus. Effect of strong soil moisture upon drop of young fruit.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 152-7, bibl. 4.

Trials were made near Glendora, Calif., of the effect of high, medium and low soil moisture on the June drop of Washington Navel oranges and of Valencia oranges near La Hatra, Calif. High water deficits were developed in some cases, but the set of fruit was little or not at all affected. It is noted that during the two seasons of the experiments no abnormally high temperatures were encountered.

1120. MILLER, E. V., WINSTON, J. R., AND SCHOMER, H. A. 634.31 : 581.192

Physiological studies of plastid pigments* in rinds of maturing oranges.

J. agric. Res., 1940, 60 : 259-67, bibl. 12.

Adaptation of the Clifford photometer for quantitative determinations of the plastid pigments is described. Periodic analyses were made on the rinds of early (Parson Brown), midseason (Pineapple), and late (Valencia) Florida oranges from the time they were mature green until long after their marketing season. The results show that as the chlorophyll decreased the carotenoids increased and continued to increase after the chlorophyll had disappeared. Fully colored tangerine and Temple orange rinds contained a greater quantity of carotenoid pigments than the rinds of the mature green fruit. Ethylene treatment of mature green oranges stimulated decomposition of chlorophyll without any significant effect on the carotenoid pigments. In the

* For study of the rind colour of other citrus fruits, see *Science*, 1938, 87 : 394-5 (noted only, H.A. 8 : 1164).

samples taken when the fruits were mature green the methanol fraction (xanthophyll) predominated in the carotenoids in the rind. Later, when the fruit had attained its highest carotenoid content, the petroleum-ether fraction (cryptoxanthin, carotene) was much higher than the methanol fraction. Pineapple oranges selected from the north-east side of the tree in the spring owe their superiority in color over those on the south-west side to the higher petroleum-ether fraction of the carotenoids. This is true also when there is a difference in color of the two sides of the same fruit. [Authors' summary.]

1121. ARESHKINA, L. YA. 634.322-1.8

The effect of manuring on fruits of Unshiu mandarins. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 32-3.

The study was made at the Batum Botanical Garden. The treatments were:—farmyard manure, NPK, NK, NP, PK and O. The results may be summed up as follows:—Farmyard manure delayed maturity. Potash plots ripened earlier. Fruits from plots receiving N had more peel, more sugar and less juice. KN manuring increased total acidity. P decreased acidity but gave an increase in sugars and water-soluble substances. Farmyard manure had no effect in either direction. K increased fruit flesh. P had no effect in this respect.

1122. CHAPMAN, G., LIEBIG, G. F., AND PARKER, E. R. 634.3-2.19 : 546.711

Manganese studies Calif. soils and citrus leaf symptoms of deficiency. I and II.

Calif. Citrogr., 1939, 24 : 427, 454, and *Ibidem*, 25 : 11, 15, bibl. 9.

I. For the study of the manganese situation in California soils citrus trees, owing to their sensitivity, were used in controlled nutrient cultures. Printed evidence of manganese deficiency symptoms in citrus is somewhat discordant. Resulting from the present investigation photographs are presented showing 6 stages of manganese deficiency symptoms in lemon leaves. The mild stage is indistinguishable from mild zinc deficiency but at this and all other stages the leaves will turn green on treatment with solutions of manganese chloride or sulphate while treatments with zinc have no such effect.

II. Photographs are presented showing manganese deficiency symptoms on Valencia and Navel oranges grown in sand culture in the greenhouse. Similar symptoms were produced in sweet orange and grapefruit seedlings. Other data obtained are the same as for lemons. The symptoms were brought on in manganese-deficient solutions maintained at pH 7. No symptoms developed at pH 5; 0.06 p.p.m. manganese was found in solutions maintained at pH 5 and none at pH 7. The same results were obtained on large trees in sand cultures out of doors, i.e. with manganese-deficient nutrient solutions at pH 7 deficiency symptoms occurred but not with identical solutions at pH 5 to 6. The fundamental pattern produced by deficiency in a mature leaf is that of a green midrib and main veins with a green band of variable width on either side. The interveinal areas are a lighter green but usually less pronounced than in mottle-leaf. A series of lighter coloured spots distributed at random over the lighter coloured interveinal areas is a frequent though not invariable symptom. These may coalesce with blotches. Fruiting of manganese-deficient trees appears to be seriously reduced. Other factors besides soil reaction probably determine manganese adequacy, these include quantity and kind of manganese-bearing minerals native to the soil, cultural treatments, the manganese requirements of the crop and the phosphate status of the soil.

1123. SCHULTZ, E. F. 634.3-1.874

Cultivos intercalables convenientes e inconvenientes para las quintas de cítricos. (Cover crops, good and bad, for citrus.)

Rev. industr. agric. Tucuman, 1939, 29 : 161-75, being *Circ. Estac. exp. agric. Tucuman* 76.

Certain leguminous crops commonly used for cover crops are discussed with a view to their employment in citrus plantations in the Argentine. On the whole the author prefers clean cultivation on the ground that spring cover crops, if irrigated, cause early shooting in the citrus with consequent danger of frost damage, while, if there is no irrigation, they use up the soil moisture to the detriment of the citrus. In summer they are useful in keeping down weeds in the wetter districts where weed growth is rapid. The cowpea, *Vigna sinensis* Endl., and *V. catjang* for normal and *Stizolobium Deeringianum* Bort. for moister districts are recommended.

Some notes on the species grown at Tucuman Experiment Station are given. Cowpeas *Vigna* spp. have proved, when sown in November, of rapid and dense growth well suited for smothering weeds. The most vigorous kinds were Victor, Whippoorwill, Groit and Taylor. A disadvantage of the cowpea is its short growing season (4 months). Tucuman No. 22, a selected variety, has a season of 5 months which is long enough to prevent the weed seeds from germinating till the hot weather when clean cultivation is practised. The cowpea does not require bacterial inoculation. *Stizolobium Deeringianum* is even more vigorous than the cowpea if planted early, i.e. in cool weather. If planted late it runs to seed. Unlike the cowpea the seeds are formed low down on the plant and are difficult to harvest. It is subject to insect attack which can only be met by spraying with lead arsenate thus rendering its highly nutritious foliage unfit for fodder. Owing to its matted growth it is not easy to cut. *Desmodium tortuosum* grows to a height of 1.80 metres. During dry weather it ceases growth but responds immediately to a shower of rain. It produces seed abundantly and can be relied on to resow itself annually, the fallen seed being, until the spring germination, quite unperturbed by the disturbances of the customary summer clean tillage. At 15-20 cm. high it is good practice to cut the plant down and feed it to cattle, which much appreciate it, and to plough in the second growth in late spring. *Phaseolus Mungo* is a tropical plant and grows slowly at Tucuman, requiring one or two hoeings in the process and, although it eventually gives good coverage, this detracts from its utility. *Cajanus indicus*, pigeon pea, grows 60 cm. in Florida but from 1.50 to 2.50 metres in Tucuman and forms hard stems which are difficult to dig in. Since it also requires weeding it is regarded unfavourably. *Stizolobium* sp. has a long vegetative period and on this account seed is difficult to get. It is of low, rapid growth and if given its head will completely blot out in six months even such vegetable "toughs" as Bermuda grass and *Cyperus*. It is an excellent fodder plant if fed young; if too old the excess of fibre may cause digestive troubles. It grows better in the north Argentine than it does in Tucuman. A list without comment is given of the leguminous cover crops which were tried and proved failures.

1124. URUSHADZE, D. K. 634.334-1.874
Leguminous crops for lemons. [Russian.]
Soviet Subtropics, 1940, No. 4 (68), pp. 33-5.

Lemon trees interplanted with *Vigna sinensis* and other leguminous plants at the Beria State farm (U.S.S.R.) had somewhat poorer crops in the first year but appreciably higher in the second year than when not interplanted.

1125. GOCHOLASHVILI, M. M. 634.334-2.111.2-1.8
The effect of manuring on hardiness of lemon trees. [Russian.]
Soviet Subtropics, 1940, No. 4 (68), pp. 8-14.

Experiments were conducted at the Batum Botanical Garden on lemons as well as on mandarins. Results are tabulated and discussed in some detail. They may be summarized as follows:—All kinds of manures gave increased frost resistance (as measured by exposure of cut-off branches to low temperature in freezing chamber) over controls. Increased hardiness was mainly due to a more vigorous development of the plants in the early part of the growth period. Mineral fertilizer and Kerch slag was particularly useful in this respect. The branches of lemon trees receiving that particular treatment could be kept without injury at -8°C . for 6 hours, having more than doubled their degree of hardiness.

1126. MOROZ, E. S. 634.334-2.111 : 612.014.44
The use of photoperiodism on individually frost-protected lemon trees. [Russian,
 English summary 6 lines.]
Publ. (Zbirnik Prats) Ukrain. Acad. Sci. Kiev, 1938, pp. 259-65, bibl. 9.

Under Sukhum conditions hardiness of one-, two- and four-year-old lemon trees could be improved by a curtailment of natural daylight in autumn and winter by 3 to 4 hours. This was done by placing the plants in light-proof cardboard boxes with adjustable shutters, the latter preferably facing east. The plants used in the trials were lemons on lemon stocks and on *Poncirus trifoliata* stocks.

1127. FINCH, A. H., AND McGEORGE, W. T. 634.323-1.8
Studies of grapefruit fertilization in Arizona.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 62-7, bibl. 3.
 MARTIN, W. E. 634.323-1.8
Some effects of cultural practices upon tree composition, yield and quality of Marsh grapefruit in Arizona.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 68-75, bibl. 9.

Results of experiments carried out at the Yuma Mesa Experimental Farm, Arizona, in 1936-9 confirm the important rôle played by nitrogen in regulating fruitfulness in grapefruit. Preliminary evidence was produced that the P, Ca and possibly the ash content of the leaves was in some way influenced by the application of nitrogen. Cultivation trials for two years with trees on the same farm are described in the second article. The nitrogen, starch and sugar contents were noted at different periods in conjunction with the application or withholding of nitrogen. Nitrogen manuring during the winter in conjunction with clean cultivation made for a high N content prior to bloom and to the maintenance of satisfactory yields, whereas its application in summer resulted in a vegetative tree condition and coarse-textured low grade fruit. The growth of cover crops and withholding N in the winter tended to reduce production. Growth of cover crops in the summer following winter application of N resulted in decreased N content and increased the proportion of high grade fruit.

1128. RHOADS, A. S. 634.3-2.4
The cause and control of melanose.
Citrus Ind., 1940, 21: 6: 5, 9, 12.

Melanose of citrus is the name given to the attacks of the fungus, *Phomopsis Citri*, on the foliage, shoots and fruit at a time when they are still soft. In the two first this period lasts for 3 weeks from the shooting of the bud; in the fruit this immunity stage is based on diameter, i.e. 1 inch for tangerines, 1½ inches for oranges, 3 inches for grapefruit. Control is a difficult problem. Spraying with bordeaux mixture will control ordinary outbreaks if there is not a large quantity of dead wood, but a combination of spraying and the removal of dead wood is the most effective. Steps should be taken to see that the tree is kept in such health that dead wood does not accumulate. Spraying with bordeaux or other copper sprays favours an increase of scale, white fly and rust mites. Insect control is therefore also necessary and suggestions for it are made, but basic copper sulphate, copper ammonium silicate and cuprous oxide lead to less increase than bordeaux, and the application of the sprays as fine mist on the outside of the trees, instead of drenching the interiors, will also reduce attack. Secondary benefits of copper sprays are the considerable reduction of stem-end rot and of dieback (exanthema) which results from copper deficiency.

1129. BAKER, R. E. D. 634.3-2.4
The influence of climatic factors on citrus scab disease.
Trop. Agriculturist, 1940, 17: 83-6, bibl. 10.

Conditions for citrus scab (*Elsinoe Citri*) infection are an abundant supply of spores and a suitable growth stage in the host plant, which in the case of orange and grapefruit is when the young leaves are less than ½ inch across or the young fruits less than ¾ inch in diameter. An atmosphere of nearly 100% saturation and a temperature below 74° F. are also necessary for a period of 12-16 hours for the grapefruit strain and possibly a shorter time for the sour orange strain (in Trinidad). Thus in tropical Trinidad with its continuous plant growth the risk of infection is permanent, whereas in sub-tropical Florida the only real danger exists in the spring. However, in Trinidad it is shown that in June and July the weather is usually at its most suitable for scab development and that from June to December is a more infective period than January to May. Spraying is necessary to control the disease but the kind of spray and number of applications must be decided by the climate of the area concerned. Investigations by the Department of Agriculture suggest that while 2 or more copper sprays may be necessary in some districts, in others a clean up spray just before the flowers appear may be adequate.

1130. BENSÁUDE, M. 634.3-2.411
O aguado das laranjeiras e limoeiros. (**Control of *Phytophthora hibernalis* in oranges and lemons in Portugal.**)

Ser. Divulgação Minist. Agric. Lisboa 7, 1937, pp. 7.

This rot was first reported and described by Carne from Western Australia and shortly afterwards from Portugal by Moniz da Maia. Its specific name is derived from the fact that it needs a moderately cool temperature, under 68° F., and a moist atmosphere for effective development, and is thus particularly dangerous during the winter and early spring rains. It has been known to destroy up to 90% of the fruit and to cause severe defoliation. Infection generally starts at the ends of the leaves and spreads inwards to the peduncle. Trees on the wetter soils are most seriously attacked. The disease can be controlled to a great extent by the application of a series of a spray (November, January and March in Portugal) of bordeaux mixture to which has been added a 2% oil emulsion as an insecticide to check the increase of scale which follows a bordeaux spray. There are several proprietary sprays suitable for this such as Volk, Abolium or Soluvol. If the insecticide is applied separately Red or White Spraying Oil is suggested.

1131. WOGLUM, R. S., AND LEWIS, H. C. 632.754 : 634.3
Whitewash to control potato leafhopper on citrus.
J. econ. Ent., 1940, 33 : 83-5, bibl. 3.

Leafhoppers (*Empoasca fabae*) damaging oranges in California have been successfully controlled by an outside coating of the entire tree with a whitewash spray composed of 100 lb. hydrated lime, 25 lb. zinc sulphate, 12 oz. blood and albumin spreader, 300 gallons water. The zinc also benefits tree growth and reduces mottle leaf. The spray is applied in November, picking being in April. 37% improvement over untreated orchards has been obtained.

1132. OSBURN, M. R. 632.654.2 : 634.3
Costs of control measures for the citrus rust mite.
J. econ. Ent., 1940, 33 : 393-6.

The costs of sulphur spray and dust treatments for the successful control of the citrus rust mite (*Phyllocoptes oleivorus*) in 6 orange groves for a period of 4 years are here discussed.

1133. BOYCE, A. M. 634.334-2.73
Tartar emetic for control of citrus thrips on lemons.
Calif. Citrogr., 1940, 25 : 100.

At the Citrus Experiment Station, Riverside, tartar emetic (potassium antimonyl tartrate) has proved an effective control for citrus thrips when used as a spray. The formula is 1-2 lb. tartar emetic, 2 lb. cane or beet sugar, 100 gallons water. Tartar emetic proved superior to sulphur dust or lime-sulphur sprays. There was no injury to leaves or fruit except that on the leaves a dark brown area forms at spots already showing leaf or mechanical injury. Treated plots have shown marked growth response in comparison with untreated. An optimum programme has not yet been worked out but two spring treatments followed by one in late summer are effective.

1134. SOARES, M. DE B. 634.3-1.536
Uma embalagem para citrinos. (**Packing citrus trees for transport.**)
Ser. Divulgação Minist. Agric. Lisboa 17, 1939, pp. 12.

Instructions for packing and lifting citrus with ball of soil attached.

1135. MAUERHAN, C. J. 632.64
Economical control of snails.
Calif. Citrogr., 1940, 25 : 227.

BASINGER, A. J. 632.64
Brown snail infestations.
Ibidem, 25 : 226.

The European brown snail which often becomes a pest in Californian orange groves by ascending the trees and damaging the young fruits can be controlled by hand broadcasting a poison bait into the tree, on the limbs and on the ground round the tree. The easily prepared bait recommended here is ground orange meal 15 lb., calcium arsenate 1 lb., mixed dry and enough water

added just to moisten the meal so that it will not cake when pressed in the hand. The bait may be broadcast any time except during rain, but after rain or on foggy mornings are especially suitable times. Two or possibly three applications at several weeks' interval, in particular after the first irrigation, are advised. To control snails in citrus trees the spray commonly used for brown mottle-leaf of citrus, i.e. 2½ lb. zinc sulphate, 1 lb. copper sulphate, 2 lb. hydrated lime, 100 gall. water applied during damp weather, is applied before July if possible. The spray acts as a repellent and a few days later a poison bait such as is mentioned above is scattered under the trees from trunk to drip. Bran may be used instead of orange meal. If damage to fruit is not extensive the spray may be omitted and the bait alone used. Basinger disapproves of broadcasting into the tree because rain or dew may dissolve enough arsenic to injure it.

1136. EYRE, J. C. 634.3

Notes on the planting and maintenance of citrus trees.

E. Afr. agric. J., 1940, 5: 413-5.

WONG, C. Y.

581.162.3: 634.3

The influence of pollination on seed development in certain varieties of citrus.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 161-4, bibl. 9.

- HILGEMAN, R. H., SMITH, J. G., AND DRAPER, G. E. 634.3-1.84

A preliminary note on nitrogen assimilation by citrus trees.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 58-61, bibl. 3.

KOECHERT, R. E.

634.3-2.95

Pflanzenschutzwesen im Citrusbau im Staat São Paulo, Brasilien. (**Plant protection in the citrus groves in São Paulo, Brazil.**) [English, French and Spanish summaries.]

Nachr. SchädlBekämpf, 1939, 14: 73-85.

1137. COOPER, W. C., AND KNOWLTON, K. R. 577.15.04: 634.1/7: 551.56

The effect of synthetic growth substances on the rooting of subtropical fruit plants.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 1093-8, bibl. 4.

Cuttings of 16 different varieties of *Citrus*, including grapefruit and sour and sweet oranges, were successfully rooted by the standard treatment of soaking the basal ends of the cuttings in aqueous solutions of indoleacetic acid. The treated lots in nearly every instance had a higher percentage of rooted cuttings and a greater number of roots per cutting than was produced by controls. The standard treatment also resulted in a higher percentage of cuttings which rooted and a greater number of roots per cutting than controls on lychee, *Carissa*, Ceylon gooseberry, governor's-plum, grumichama (*Eugenia Dombeyi*), sapodilla, guava, and *Diospyros montana*. Dust containing naphthaleneacetic acid was found to be effective in rooting cuttings of lime, lemon, *Carissa*, Ceylon gooseberry and governor's-plum. The dust, however, had no effect on cuttings of grapefruit, mandarin, sour and sweet oranges, and lychee. [Authors' summary.] The experiments described were carried out in Florida.

1138. KALMYKOV, S. S. 633/634: 551.56

Subtropicals in Kazakh S.S.R. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 26-7.

Some 60 species of different subtropical plants raised from the seed obtained from various institutes in humid subtropics were tested for 4 years at the Bostandyk research field of the Kazakh agricultural institute. Only about one-third of those tested were found suitable for cultivation in the Kazakh S.S.R. *Tea*.—The main difficulties encountered were lack of moisture in the air and alkalinity of the soil. Mention is made of a drought-resistant, small-leaved china tea strain selected by the Institute of Tea Production, with the seed of which better results have been obtained. *Japanese date*.—In 1937 65 three-year-old seedlings were planted. They all died back to the rootstock as a result of frost in their first year. Seedlings sown in 1938 showed a greater hardiness. *Virginian date* and *pecans*.—Hardy seedlings are now 2 and 3 years old. *Tung oil*.—*A. Fordii* and *A. cordata* at first grew well but were killed by cold in winter. *Pistachio*.—Seed was obtained from Nikita Botanical Garden. During the first winter all

seedlings showed severe frost injury down to the root collar. *Fig*, *pomegranate*, *Eucommia*, *box* and *cypress* adapted themselves with ease to the Kazakh conditions. Other plants are still under trial.

1139. KUPRIANOV, I. 631.459

Perennial herbaceous plants on the Black Sea Coast of Caucasus. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 42-4.

Under Black Sea Coast conditions it was found possible to control soil erosion and to maintain the fertility of orchard lands and tobacco plantations by sowing *Hothus corniculatus*.

1140. (i) MORGAN, N. D. 633.492-1.8

Relation of fertilization to the yield and keeping quality of sweet potatoes.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 849-54, bibl. 17.

- (ii) EDMOND, J. B., AND DUNKELBERG, G. H. 633.492-1.588.1

Experiments with electricity in sweet potato plant production.

Ibidem, 37: 855-6.

- (iii) TIEDJENS, V. A., AND SCHERMERHORN, L. G. 633.492-1.8

Recent studies on fertilizer applications for Gold Skin sweet potatoes.

Ibidem, 37: 857-9.

(i) In coarse sandy soil in North Louisiana sweet potatoes grown with a complete fertilizer containing a good proportion of potash, i.e. between 12 and 18%, applied at the ratio of 750 lb. an acre, produced good crops with better storage capacity than those grown without fertilizer.

(ii) Experiments at Clemson, S. Carolina, which are to be reported in full in the 52nd *A. R. S. Carolina agric. Exp. Stat.*, are here very briefly reported on the use of various materials for electrically heating sweet potato hotbeds.

(iii) Investigations in New Jersey indicate that fertilizer should be applied so as not to come in close contact with the roots of sweet potato when the plants are set. Deferred applications increased yields. Applying in solution form was more successful than standard methods. The application of superphosphate only, with or without lime, followed later by that of nitrogen and potassium, produced the largest increases in yield.

1141. GOLOVIN, P. 633.85

Diseases of southern oil plants. [Russian, English summaries for each section.]

Acta Univ. Asiae Mediae, Ser. VIII-C., Botanica, Tashkent, 1937, Fasciculus 35, pp. 76.

The following plants are considered:—*Sesamum indicum* L., *Arachis hypogaea* L., *Ricinus communis* L., *Carthamus tinctorius* and *Cyperus esculentus* L.

1142. KIBARDIN, R. E., AND SKOROBOGATOV, M. E. 633.85

Tung trees on the Southern slopes of Caucasian Mountains. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 51-3.

Experience with tung trees in Parzivan (semi-humid subtropical zone of Azerbaijan) shows that *Aleurites Fordii* should be given preference to *A. cordata* on account of its greater hardiness, drought resistance and vigour. Irrigation in some form was found necessary for tung trees grown on sloping ground. The plantings should be started with one- or two-year-old cuttings and not from seed.

1143. PAINTER, J. H., AND BROWN, R. T. 633.85-1.542.24

Effect of different methods of girdling tung branches.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 511-4.

Experiments at Cairo, Georgia, U.S.A., indicate that the tung tree can be effectively girdled for experimental purposes by any of several methods. Probably the best method is the removal of a strip of bark $\frac{1}{4}$ inch wide, but the double knife cut about $\frac{1}{2}$ inch apart without the removal of the bark also seems satisfactory. A wax covering is advisable to ensure the survival of the branch, and branches should not be girdled later than mid-August in Georgia.

1144. FROLOV, T. V. 633.91

Guayule cultivation in U.S.S.R. [Russian.]
Soviet Subtropics, 1940, No. 4 (68), pp. 35-7.

Guayule has been cultivated for some time in Azerbaijan and other subtropical areas of U.S.S.R. One-year cultivation is possible but is more expensive than normal three-year cultivation. Watering greatly increases seed yields and is a standard method in seed propagation work. Last year's seed is used for sowing in mid-April. To obtain a more even germination the seed is soaked for 10 hours [presumably in cold water] and dried in the shade to 25% moisture. It is sown shallow. Some 4-7 kg. seed are required for 1 ha., depending on whether all plants are transplanted at the end of the first year or the less vigorous ones are left for another year in the nursery. Flood irrigation is practised, its main feature being the gradual cutting down of water supplies. An account is given of the care needed in the nursery, during transplanting and after planting. The feeding area required by guayule plants is discussed and cultivation, harvesting and seed production are described.

1145. KRASHENNIKOV, N. A., AND AGEEV, L. A. 633.91-1.67

Rearing guayule in irrigated nursery beds. [Russian.]
Soviet Subtropics, 1940, No. 4 (68), pp. 38-41.

The care of guayule seedlings in a nursery in Southern U.S.S.R. consists of weeding, cultivation between the rows and irrigation. Accounts of the methods used are given. The nursery beds should contain as many plants as possible, as this reduces the cost appreciably. On transplanting in the first year the less vigorous plants are left in the nursery beds for one more year. In this way most of the nursery material can be used.

1146. HODGSON, R. W. 634.451-1.541.11

Rootstocks for the oriental persimmon.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 338-9, bibl. 2.

From the evidence afforded by trials which were started in 1934 in California, but have suffered from certain vicissitudes since, the following preliminary indications are forthcoming. The lotus persimmon (*Diospyros Lotus*) is not a satisfactory stock for the Fuyu variety of kaki in California. *D. virginiana* is satisfactory for this variety. *D. Lotus* is found to invigorate the Hachiya variety, which may be the reason for the excessive premature fruit fall in Hachiya. *D. Kaki* exhibits a wider range of commercial compatibility than either of the other two rootstocks.

1147. HOLM, J. M. 634.58

The Bambarra groundnut or Njugo bean.
Fmg S. Afr., 1940, **15** : 195-8, 200, bibl. 20, reprinted as *Pamphl. S. Afr. Dep. Agric.* **215** (Chemical Series **161**), pp. 10.

The leguminous Njugo bean (*Voandzeia subterranea*), although cultivated in many countries, has never received the recognition it deserves as a food or a source of edible or industrial oil. The plant is a prostrate herb maturing its seed underground after the manner of the groundnut, with which plant it ranks about equal as a host for nitrogen-fixing bacteria. There are a large number of varieties distinguished mainly by the colour of their seeds. In cultivation the plant requires heat, a frost-free period of 3½ months and a loose sandy or sandy loam soil with a fair amount of lime and organic matter. Earthing up at flowering time is essential. Harvesting is done by loosening the soil and pulling up the plant or by using a single furrow plough. Shelling is by flail and not by hand as in the case of the groundnut. The leaves form a useful feed for stock but are seldom conserved. There are no pests and diseases of importance at the moment. A chemical analysis of various parts of the plant is given. With its high content of protein, fat and mineral elements the bean compares very favourably with maize.

1148. ALDRICH, W. W., AND CRAWFORD, C. L. 634.62

Dryweight increase curves for date fruit.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 187-90, bibl. 1.

Rate of increase of dry weight of the date is very much greater in late August and September in California than in the earlier part of the summer.

1149. SABET, Y. 634.62 : 581.144.2 : 581.8
Mycorrhizal habit in the date palm (*Phoenix dactylifera* L.).
Nature, 1940, 145 : 782-3.

The author found that date seedlings up to 8 months old grown in the sandy garden of the Faculty of Science, Abbasieh, Cairo, were free from mycorrhiza. Nevertheless in 15-month-old plants grown in plots containing Nile silt the mycorrhizal association was quite visible. Cultivation of the fungus concerned and its cytology are under investigation. Here an account is given of its effect on and spread in the roots, which become hypertrophied, relatively more thickened and more opaque than non-infected roots.

1150. CHABROLIN, C. 634.63
 La multiplication de l'olivier. I. Les procédés de plantation de l'olivier dans la Tunisie du Nord. (**Olive production. I. Olive planting in Northern Tunisia.**)
Tunisie agric., 1939, 40 : 47-51, bibl. 5.
 VALDEYRON, M. 634.63
 II. Amélioration génétique de l'olivier. (**Olive improvement by means of genetics.**)
Ibidem, 40 : 52-5.
 COEYTAUX, H. 634.63
 III. Idées générales sur la création d'une oliveraie. (**General principles on the establishment of an olive grove.**)
Ibidem, 40 : 56-76, bibl. 6.

In these articles the olive investigator will find many useful hints primarily intended for the Tunisian grower. In the first Chabrolin considers methods of reproduction, rejecting sexual in favour of asexual methods and advocating the use of ovuli or of large cuttings for the reproduction of oil varieties and of shield budding on trees obtained thus for table olives. The second author deals with varietal selection and the help which it can afford towards improvement of oil quantity and quality. Against the ravages of *Bacterium Savastanoi* probably only long time hybridization experiments can prevail. In the third article the adaptation of guiding principles to the particular problems of Tunisia is considered. When considering the suitability of any particular soil for olive planting the closest attention should be paid to the soil in relation to water supply. The choice of variety is discussed. Treatment of soil before and after planting receives attention. Finally the care of the planted olive is considered and lessons are drawn from the Cazalet plantation of 500 hectares, the trees in which were planted and cared for in different ways and now show the results of their various treatments. In addition, at the end of the articles are a number of interesting notes from members on methods of propagating and cultivating the olive. [For a complete treatise on olive growing in Tunisia the reader is referred to Tourniéroux, J. A., *L'oléiculture en Tunisie*, *Bull. Dir. Agric. Tunis*, edition 1929.]

1151. MORETTINI, A. 634.63-2.19
 Primo contributo allo studio della cascola dei fiori e dei frutti nell'olivo.
 (**A preliminary note on the fall of flowers and fruit in the olive.**)
 Reproduced from *Att. Accad. Georgofili*, 1940, vol. 18, pp. 22.

In Italy the olive sets only about 5-10% of its flowers as compared with apricot 14%, pear 25%, plum 27%, cherry 45% and peach 55%. In this survey of the excessive fall of flowers and fruit the author considers the phenomenon in the four periods of its occurrence, namely between the end of April and the beginning of June, early July to early August, August and September, and just before harvesting early in November. The causes in the first period would appear to be ineffective pollination, ovary abortion in a very few varieties, and olive moth (*Prays oleellus*) larvae. In the second ineffective pollination is still a cause and the quantity and quality of the cell sap here plays its part. The third and most noticeable fall is very largely due to the ravages of the 3rd generation of the olive moth, and the fourth and last to the same pest and very slightly to the olive fly (*Dacus oleae*).

1152. LE ROUX, J. C.

634.653

The avocado in South Africa.*Fmg S. Afr.*, 1940, 15 : 89-92, 147-9, bibl. 11.

Part I deals with soil and climatic requirements, varieties, and methods of propagation. In general the avocado will thrive in soil ranging from light sandy to clay loam, provided drainage is good and there is a permeable subsoil. The climatic requirements appear to be a relatively low winter and high spring and summer temperatures with low atmospheric humidity during flowering and setting. The Mexican varieties (*Persea drymifolia* Cham. and Schlecht) are more resistant to cold than the West Indian and Guatemalan races (*P. americana* Mill.). Avocado is easily damaged by wind. Propagation is by budding or grafting on seedling rootstock. The Mexican stock is the most suitable for Mexican and Guatemalan varieties, and Mexican seedling trees produce large quantities of small fruits which yield fairly uniform seeds. The seeds are planted tip upwards in the nursery row in sandy soil and only just covered or, as is often considered preferable, they may be previously sprouted in the beds or flats before planting out. They are ready for working a year later. The most successful method of budding in South Africa is to insert a fairly wide patch bud shield $1\frac{1}{4}$ inches in length in an ordinary T cut. The wood is removed from the back of the bud. In wrapping prominent eyes are left uncovered but flatter ones are covered. The trees can be planted out as a rule within 10 months of budding or often within $1\frac{1}{2}$ years after sowing the seed, whereas in California 2-2 $\frac{1}{2}$ years must elapse. For transplanting, trees may be balled or the roots packed in wet moss, in either case any drying out must be avoided. A frequent cause of failure, especially where there is rapid growth, is the omission to loosen and retie the wrappers frequently.

Part II. The establishment and management of an orchard, and marketing. Useful lists of varieties are given and classified according to type, time of flowering and, most important, whether receptive of pollen or discharging the pollen morning or afternoon. To ensure adequate pollination varieties from each group should be planted, i.e. those which are receptive only in the morning and discharge pollen only in the afternoon, and those which reverse the times. Irrigation is necessary but water must not stand. Trees must be adequately manured, otherwise they will flourish for a few years and then die off without warning. Fertilizers must be spread and not placed in a concentrated ring round the tree, as the roots are very sensitive to high concentrations. After shaping in the nursery little pruning is required and attempts to change tree form in this manner reduce tree size and yield. The correct time for picking is when the consistent increase in fat content has ceased and before it begins to decline. In South Africa the correct hard-ripe stage of maturity for picking is ascertained by picking a few of the most advanced fruits at intervals and storing them until they ripen normally without shrivelling.

1153. GUADAGNIN, L.

634.653-1.541

Enxertia de mesa paro o abacateiro. (**Bench grafting the avocado.**)*Ceres*, 1939, 1 : 237-43.

Bench grafting the avocado is described as a new method for this plant. The seedling stocks are brought to the grafting bench when about 5 mm. in diameter, at which stage they still possess some food reserves, this being important for the success of the graft. The grafting method used is the whip and tongue. The tie is made with raffia which must be thin enough to break as the plant grows. Waxing the graft is almost essential if a high percentage of success is to be obtained. The formula suggested is pure beeswax 100 g., pitch 30 g., tallow 10 g. After grafting the grafts are planted in baskets, kept if possible under glass, and given careful attention especially in the matter of watering which must be adequate but not overdone. Any buds starting on the stock must be removed. The scion should start to shoot in 30-35 days. In a year or two the point of union becomes practically invisible, indicating the suitability of this type of graft.

1154. MILLER, J. C.

634.653

Avocado tree decline studied.*Calavo News*, 1940, 14 : 3 : 3.

In a very brief note on the causes of avocado tree decline in California the more important factors are stated to be climate, soil and orchard management and the relationship of the root to these three factors. On account of the requirements of the Fuerte, one of the most important

varieties, the climate factor is dominant and the situations where the climate is favourable do not happen to be those with the most suitable soils. The presence of a water table under the trees causes serious root injury, largely due to the creation of a favourable environment for the development of the fungus, *Phytophthora Cinnamomi*, which otherwise, although often present, does not cause injury. Under laboratory conditions the presence of a water table has caused serious root injury in 3 days.

1155. DRUMMOND, O. A. 634.653-2.4

A verrugose do abacateiro. (**Avocado scab.**)

Ceres, 1939, 1: 249-55, bibl. 2.

Avocado scab (*Sphaceloma Perseae*), its symptoms and method of treatment, are described. The usual suggestions of importation or use of only disease-free stock or resistant varieties are made. To deal with disease already present a fortnightly spraying in the nursery and a monthly one in the plantations with bordeaux 1:1:100 is recommended for dry weather, these periods to be exchanged during rainy weather when the fungus is most active. In cases of really bad attack it is better to remove the damaged shoots at flowering time and sacrifice the crop rather than allow the fruit to form a source of fresh infection. There are no immune varieties but there are degrees of resistance and some varieties are attacked in twigs and leaves and scarcely at all in the fruit. The use of resistant varieties as stocks is rendered difficult from the fact that the native varieties are very common and seed of others is difficult to obtain.

1156. LINDGREN, D. L., AND MCKENZIE, H. L. 634.653-2.944-2.752

Atmospheric HCN fumigation for *Latania* scale on avocado fruits.

Pap. Calif. Citrus Exp. Stat. Riverside No. 354, undated, received March 1940, pp. 369-76.

From experiments made in a 450 cubic foot fumatorium it is concluded that *latania* scale (*Aspidiotus lataniae* Sign.) can be killed under similar conditions by a dosage of 25 c.cm. of liquid hydrocyanic acid or its equivalent per 100 cubic feet with a load of 50 avocado boxes and an exposure of one hour, with electric fan circulation.

1157. RIPLEY, L. B., AND PETTY, B. K. 632.754: 634.973.737

Dusting for frog hopper in wattles.

Fmg S. Afr., 1940, 15: 218, 222.

The so-called frog hoppers attacking wattles in South Africa are really jassids and a species of capsid. Pyrethrum dust diluted with talc was the most effective means of control, the dilution being 1 part pyrethrum to 20 talc in the laboratory but possibly 1-15 in the field. There are great differences in results according to the grade of talc used, and manufacturers of the powder were notified. Laboratory tests suggest that for trees 6-8 ft. high the amount of dust will be about 10 lb. per acre. It can be applied with hand dusters already in extensive use for applying cryolite against bagworm. With these and a total length of piping of 6 ft. trees can be dusted up to 12 feet. It is emphasized that the work is still in the experimental stage especially as regards the amount of dilution possible, it having been found that the young are killed much more easily than the adults. Dusting will be too late unless it is done before the damage begins to show, which is usually during the latter half of the summer.

1158. SMIRNOV-LOGINOV, V. P., AND FESENKOVA, N. G. 631.459
Soil erosion in the humid subtropics of Azerbaijan. [Russian, English summary 2 pp.]

Azfan, Baku, 1939, pp. 42, bibl. 23.

TRUSHINSKY, G. M.

631.3: 633.834

The use of combines for harvesting nutmeg. [Russian.]

Mech.-Electr. Moscow, 1939, No. 7, pp. 46-7.

POTTER, G. F., ANGELO, E., PAINTER, J. H., AND BROWN, R. T. 633.85

A statistical study of variation in tung fruits.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 515-7, bibl. 2.

- ANGÈLO, E., AND POTTER, G. F. 633.85
The error of sampling in studying distribution of the root system of tung trees by means of the Veihmeyer soil tube.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 518-20, bibl. 2.
- JONES, W. W. 634.651-2.77
The influence of relative humidity on the respiration of papaya at high temperatures.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 119-24, bibl. 10.
 The effect on papaya of heat treatment for fruit flies.

TROPICAL CROPS.

1159. VOLTEN, P. 631.16
De schuldbevrijding door middel van coöperaties. (Protection and relief of agriculturist debtors in the Netherlands Indies.) [English summary 1½ pp.]
Landbouw, 1940, 16: 77-118.

Two recent government methods for the relief of agricultural debtors in the Netherlands Indies are described. In districts of less serious indebtedness the government takes over the debts and provides for the future credit requirements of the agriculturist on easy terms with compulsory repayment in fixed instalments. In regions where debt is serious for many reasons and chances of repayment are reduced, the debtor, after release from debt, is obliged to join a co-operative society which has the power to sell his produce so that repayment of the principal is assured but also provides short term working credits. Thus payment does not exceed the capacity of the cultivators and the output is divided on a sliding scale between the debtor and creditor with a small commission for the co-operative establishment. The private money-lender is thus eliminated and the cultivator takes an increasing interest in his association as he gradually clears his debt.

1160. TATTERSFIELD, F., AND POTTER, C. 632.951
The insecticidal properties of certain species of *Annona* and of an Indian strain of *Mundulea sericea* ("supli").
Ann. appl. Biol., 1940, 27: 262-73, bibl. 24.

Various portions of *Annona muricata*, *A. palustris*, *A. reticulata*, *A. squamosa* were found in the laboratory to have aphicidal properties, which are, however, inferior to those of good *Derris elliptica* specimens and not superior to those of the leaf, bark and root of *Mundulea sericea* Wield. (supli).

1161. WATKINS, J. V. 577.15.04: 635.9: 551.56
Leaf bud cuttings for multiplying tropical shrubs.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 1109-11, bibl. 7.

Heavy rooting was obtained by the Department of Horticulture, Florida, in leaf bud cuttings of the following genera of tropical plants by the use of indolebutyric acid in talc (5 mg./g.):—*Bougainvillea*, *Citrus*, *Cocculus*, *Codiaeum*, *Ervatamia*, *Ficus*, *Gardenia*, *Hibiscus*, *Ipomaea*, *Ixora*, *Pachystachys*, *Schefferia* and *Thunbergia* and in semi-tropical species of *Azalea* and *Hydrangea*.

1162. H., A. G. 635.1/7: 631.531
Can seeds of European vegetables be produced successfully in the tropics?
E. Afr. agric. J., 1940, 5: 476-8.

From information provided by this Bureau and by the East African agricultural departments it is seen that there is no acceptable evidence that degeneration takes place in European vegetable varieties grown from seed produced in the tropics, particularly in the highland regions. A brief report of the varieties successfully grown for seed in each country is given. The results are finally summarized in a table from which it is clear that the advantage lies with Kenya, where at 5,000-5,500 feet practically every vegetable can be grown for seed, if not in one district then in another according to the suitability of local climatic conditions for the particular crop.

1163. HENNARD, P. 631.46 : 632.187
 Réaction de la microflore du sol aux feux de brousse. (**The effect of bush fires on soil microorganisms.**)
Pub. Inst. nat. Etude agron. Congo belge (I.N.E.A.C.) Ser. sci. 20, 1939, pp. 23, bibl. 5, 6 francs.

A preliminary study of the effect of bush fires on the soil microflora in the Belgian Congo shows that the destructive effect is negligible since the soil never becomes sufficiently heated to destroy the micro-organisms. On the other hand, especially in the rainy season, there is an enormous increase in the soil microflora following a bush fire. Reasons for this are not obvious and require research. It is tentatively suggested that the soil, denuded of vegetation, absorbs the sun's heat more easily. The soil temperature, once the vegetative covering is gone, will have more pronounced day and night fluctuations. The slight layer of ash resulting from the fire contains nutrient salts which in weak doses, as here, are known to stimulate soil micro-organisms, but whether by way of nutrition or by an increase in the pH of the soil which, it has been demonstrated, often results from fire, is obscure.

1164. SIRCAR, S. S. G., DE, S. C., AND BHOWMICK, H. K. 633.18 : 631.875
Micro-biological decomposition of plant materials. I. Changes in the constituents of rice straw (kanaktara) produced by micro-organisms present in soil suspension under aerobic, anaerobic and waterlogged conditions.
Ind. J. agric. Sci., 1940, 10 : 119-51, bibl. 51.
II. A note on the changes in the methoxyl and nitrogen content of lignin of rice straw during its decomposition by micro-organisms.
Ibidem, 10 : 152-7, bibl. 19.

I. The paper reports the results of studies at the Department of Chemistry, Dacca University, on the decomposition of younger and mature rice straw through the agency of micro-organisms present in an aqueous solution of well manured garden soil under the 3 conditions stated in the title and in the presence of sufficient moisture (straw : water = 1 : 10) at ordinary laboratory temperature. The decomposition was carried out in various media. The results obtained with each of these media are set out in a series of tables which show the original chemical constituents and the changes which occurred month by month for 6 months under aerobic, waterlogged and anaerobic conditions. These conditions are in descending order of their degree of influence on rate of decomposition. Younger rice straw decomposed much more rapidly and completely than mature straw. The percentage of nitrogen salts required in the medium for successful fermentation under aerobic, waterlogged and anaerobic conditions is 1.7-1.9, 1.00-1.08 and 0.45-0.50 respectively. If less is present the necessary amount should be supplied; if there is excess it is rapidly lost during the microbial processes, chiefly as ammonia. The carbohydrate materials rapidly decompose while lignin tends to accumulate. The residue left after decomposition becomes gradually poorer in carbohydrates and richer in lignins and protein-like substances and tends to approach the condition of humus.

II. There is an increase in the nitrogen and a decrease in the methoxyl content of lignin with the progress of decomposition. When the plant materials are decomposed with a mixture of calcium carbonate and ammonium carbonate the loss of methoxyl is less but the nitrogen content is higher. Loss of methoxyl is greatest under anaerobic, intermediate under waterlogged and least under aerobic conditions. The reverse is the case with the increment of nitrogen content. [From authors' summary.]

1165. GONÇALVES, A. P. 633.492
 Cultura da batata doce. (**Cultivation of sweet potatoes.**)*
Ceres, 1939, 1 : 170-6.

This is an article on the cultivation of the sweet potato in Brazil. Some of the points mentioned are:—The ground is ploughed before use to a depth of about 20 cm. The day before planting the field is ridged, the ridges being 1 metre apart and 20-25 cm. high. Some interval is necessary between ridging and planting to allow the earth to settle. The cuttings are gathered the day before and allowed to wilt in the shade so that they do not break when pressed into the ground at their middles by means of a two-pronged wooden fork, this being a rapid method of planting

* For cultivation experiments in U.S.A., see 1140.

cuttings laid out in advance in their planting positions. Cultivation should be done occasionally with a *shallow* cultivator, since it is important not to injure the roots or to cause the earth to slide from the ridges. The crop will be ready for lifting in 4-5 months from planting. This may be done by means of a convertible plough on a sunny day, although implements for the express purpose exist. The tubers can be stored for some time after 12-15 hours' exposure to the sun, in a warm airy spot or, better still, stratified in sand in such a manner that the tubers do not touch. The cuttings should be taken from selected plants and it is advisable to select these plants in the field and remove them in due course to the nursery to provide a permanent source of future cuttings. A spray formula is given for treatment of leaf pests.

1166. MARASSI, A. 633.6
Della Cordeauxia edulis. (Yebb nuts.)
Agricoltura colon., 1939, 33 : 613-26, bibl. 15.

The author considers the data afforded by Dunstan and others in the past and by various Italian scientists of late years on the chemical content of the yebb nut, a native of Abyssinia and Italian Somaliland. The analytical results, which differ somewhat, were probably deduced from specimens in different states of preservation. It is thought that they are encouraging enough to warrant a thorough examination of the plant and its products as a possible source of oil, sugar, starch, etc.

1167. DARTOIS, E. 633.61
L'industrie sucrière aux Antilles. (The sugar industry in the Antilles.)
Ann. Tech. agric., 1938, 1 : 157-71.

The author gives an account of the cultivation and processing of sugar cane in Martinique, Cuba, Porto Rico and Trinidad, noting the differences of procedure and sometimes the reasons thereof in those four groups of islands. He deals more briefly with the rum industry.

1168. PICKLES, A. 632.951.1 : 632.754 : 633.61
Control of the sugar cane frog hopper by the use of pyrethrum dust.
Proc. agric. Soc. Trin. Tob., 1940, 40 : 57-61.

It is announced that at last a thoroughly effective method of dealing with the frog hopper pest of sugar cane in Trinidad has been evolved. The frog hopper has been a serious pest of sugar cane for over 60 years and the author, though he himself does not say it, may be congratulated on having solved a problem which has hitherto defeated a long succession of entomologists, both resident and specially imported. There is an interesting account of some of the earlier work and of the stages by which the present satisfactory position was reached. The treatment now consists in dusting the cane fields with a mixture of 5 lb. pyrethrum dust (0.5% pyrethrum content) and 5 lb. sulphur per acre. Extremely powerful equipment is needed, the machine employed travelling slowly down the cane traces pulled by a powerful tractor and blowing the dust out at 180 miles per hour. The most effective time is when the insects begin feeding at 5 o'clock in the evening. Mortality obtained is between 80 and 90%. The nymphs are also affected, the dust appearing to drive them out of their spittle. Considering that a frog hopper blight produces an average loss of 9 tons of cane per acre the working expenses (materials, labour and fuel) of 1.42 dollars per acre are very moderate. It is admitted that the measures outlined are only for the large estates, but modifications to suit the needs of the small cane farmer are about to be introduced.

1169. BRIANT, A. K., AND JOHNS, R. 633.682
Cassava investigations in Zanzibar.
E. Afr. agric. J., 1940, 5 : 404-12, bibl. 3.

Various matters concerning the cultivation of cassava in Zanzibar are discussed and investigations carried out during the first 6 years at Kizimbani Experiment Station are reported. In Zanzibar planting is chiefly before the rains, but it may be done almost all the year round. Stem cuttings 8 inches long are planted on ridges 5 feet wide but in Pemba on the flat. The roots are ready to harvest in from 8 to 15 months. Direct insect damage is slight but white flies are dangerous as they are the vectors of mosaic which infects up to 75% of the plants in

the island. Cassava is sensitive to differences of soil and climate. The poorer local red soils are said to produce bitterness and roots from certain villages or with red soil adhering sell less readily. In the investigations referred to 100 varieties have been on trial and many of them discarded, usually for low yield or bitterness. There are differences in degree of susceptibility to mosaic. The heaviest yielding were Msitu (Zanzibar), Mpezaze (Amani) and Kru (Gold Coast via Amani). These three in the same order headed the list for yield in the mosaic resistance trials, i.e. for yield when grown under conditions designed to increase mosaic. The difference in yield between affected and unaffected plants of the 3 heaviest varieties was very marked, the figures for Msitu being 14·3 and 2·3 respectively. Thus the yield can be considerably increased by planting only healthy cuttings and by replacing young diseased plants with healthy cuttings as soon as infection is apparent. The difference between yield of healthy plants and those showing secondary infection is not very pronounced (primary infection=plants grown from diseased cuttings). There appears to be a correlation between the occurrence of new cases of secondary infection and climatic conditions. The method of testing new varieties occupies four stages which are described.

1170. MOLEGODA, W.

633.685

Dioscorea yams at Harispattu show.

Trop. Agriculturist, 1940, 94 : 172-3.

The giant parsnip, pride of the English flower show, would find it difficult not to acquire a permanent inferiority complex if faced with the giant yam of the recent Harispattu yam show in Ceylon. This monster stood 9 feet high, took 4 men 2 days to excavate it and required 6 men to carry it to the show on a plank 4 feet broad. It was a variety of *Dioscorea alata*. *Dioscorea* yams do best on a deep medium friable loam and are unsuited to light gravel soils or those which are heavy and ill-drained. Compost or well-rotted manure will increase yields on poor soils. Fresh cattle manure harbours insects which cause damage to yams. The crop takes 11 months to mature and should not be harvested, though it often is, until the vines have fully died down, by which time the yams are mature.

1171. DE FLUITER, H. J.

633.71 : 612.014.44

De invloed van het licht op den groei van tabaksbibt op de bedden. (Influence of light on growth of tobacco in nursery beds.)

Meded. Besoek. Proefst. 65, 1939, pp. 41-8.

A series of experiments show the favourable influence of maximum light on tobacco in nursery beds. The plants receiving full or a high degree of light not only formed better plants but resisted thrips attack, tobacco leaf spot (*Cercospora Nicotianae*) and other diseases to a great extent. The buds, therefore, should be exposed as soon as possible but this must be combined with copious watering to prevent any drying of the soil.

1172. INDIAN TEA ASSOCIATION.

633.72

A guide to Tocklai.

Scientific Department, Indian Tea Association, Tocklai, 1940, pp. 30.

This is a well illustrated guide to the history, establishment and activities of the Tocklai Tea Research Station, Assam. It also contains instructions for formulating queries, i.e. information always required before an enquiry can be answered, which should save much unnecessary correspondence, and list of publications of the Scientific Department since 1901.

1173. MUFTI-ZADE, S.

633.72

***Layout of young tea plantations in Azerbaijan.* [Russian.]**

Soviet Subtropics, 1940, No. 4 (68), pp. 28-9.

Preliminary experiments conducted by VNIChSK (U.S.S.R. scientific research institute for tea and subtropics) in Azerbaijan seem to indicate that through a suitable seed treatment [not described in detail] the need for rearing tea seedlings in the nursery becomes void and the seed can be sown in its permanent position in the plantation. Without a seed treatment young tea plants suffer badly from sunscald under Azerbaijan conditions.

1174. CHKHAIDZE, I. 633.72

Tea cultivation in the Krasnodar District. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 48-51.

Many different types of soil in the Krasnodar District were found suitable for tea cultivation on lands 200-500 m. above sea level. The pH did not exceed 6.5 to a depth of 1.5 m. The average yearly rainfall was 900 mm. and sunshine, 2,100 hours, approached the normal. Absolute minimum temperatures, however, were found to be rather low and young plants had to be mounded up with earth during their first two winters. Other frost protection measures were less effective. In the third year the plants became hardy, if sheltered from winds by wind-break belts. The best plantings were those facing West and South. The seed of a Georgian strain of hardy China tea sown in the spring germinated normally. Of the different methods of shading the young plants, shading with branches was the most effective.

1175. TUNSTALL, A. C. 632.72-2.4 : 581.144.2

Notes on root diseases of tea in north-east India.

Mem. Indian Tea Ass. 8, 1940, pp. 25.

The memorandum describes and illustrates photographically (some coloured) the more important root diseases of tea in North-East India. A useful key is provided which sets out in 2 or at most 3 lines the principal characteristics by which the disease can be recognized. There are instructions for treatment and for prevention which more or less reduce all previously suggested treatments to one, i.e. the removal of infested material and any apparently healthy bushes the roots of which have been in close contact with diseased roots. Common sources of infection are the roots of shade trees which have been felled, chiefly hardwoods, since softwoods decay too rapidly to be dangerous. When clearing old tree areas for replanting, all areas showing patches of vacancies or refills should be entirely cleared of roots which should be burned.

1176. LEACH, R. 632.4 : 633.72

Biological control and ecology of *Armillaria mellea* (Vahl) Fr. [In tea.—ED.]

Trans. Brit. mycol. Soc., 1939, 23 : 320-9, bibl. 6.

The author discusses methods of controlling *Armillaria mellea* disease in young and old tea estates. Where it exists in young plantations continual replacement of young tea bushes attacked appears to be the only remedy. By such treatment infected patches start to recover after about the 7th year from planting and after about 12 years the disease may have disappeared. The process is made quicker by eliminating the bushes at the first signs of unthriftiness. The basic means of control is by preventing the infection of the remaining roots of forest trees after the land is cleared. Ring-barking is the best method of biologic control in such cases as it results in a depletion of the roots' carbohydrate supply. If the trees are ring-barked and later felled their roots will be found to be much freer from the *Armillaria* fungus than if not so treated. The rate at which tree roots die after felling is thought to be the factor which controls the distribution of the fungus in cleaned forests. Quick death is followed by an invasion by saprophytes, but slow death allows *Armillaria* to spread. Two forest species whose roots are particularly slow dying are *Afrormosia* or "Mwanga" and *Parinari mobola* or "Muula".

1177. TRAPAIÐZE, K. G. 633.72-2.78-2.96

***Trichogramma* for the control of tea moth.** [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 30-1.

Preliminary field trials show great promise, namely 86% reduction as shown by decreased number of "mined" leaves, from the use of *Trichogramma* as a biologic control of the tea moth.

1178. GILLET, S. 633.73

Report on a visit to the coffee growing centres in Jamaica, Costa Rica, and Colombia.

Scott. Agric. Labs. Dep. Agric., Kenya, 1940, pp. 14, stencilled.

The author makes a general survey of the coffee industries of Jamaica, Costa Rica and Colombia. In this communication he describes the field and factory conditions for the benefit of the coffee growers of Kenya. On the scientific side information was acquired, particularly on the subject of quality, which is to lead to experimentation on new lines, but these matters are not discussed

here. Most attention is paid to Costa Rica, where the business of coffee growing is taken very seriously. In all three countries much damage has been caused by erosion. The consistency of the Costa Rica growers in adhering formerly to a system of growing which has proved its value is pointed out as an example to be emulated in young countries where frequent changes of system, especially in pruning, are in vogue. A system of establishing multiple-head plants in the supply nursery before planting out is worthy of consideration as being easier and cheaper than forming such plants when scattered in the field. The young plants spaced wider than usual in nursery beds are bent over when 15 months old. Later 4 heads are selected and the original bent over stem cut off. Nine months later these established multiple-headed plants can be planted out. The question of supplies is considered very important in Costa Rica and the use of a ball of earth or basket planting when planting out supplies is considered essential. The dying out of the shade tree (*Inga* sp.), commonly used in both Costa Rica and Colombia, shows the importance of using mixed plantings of shade trees instead of relying on one variety only. The extreme care taken by the Costa Ricans in the factory preparation of the bean for the London market, especially in grading, curing and hand picking, results in the production of a high quality coffee and is an example that might well be followed elsewhere.

1179. PRATT, A. M.

633.73

Coffee team services. Progress report on the cultural work at the Scott Agricultural Laboratories.

Mon. Bull. Coffee Bd Kenya, 1940, 6 : 73-6.

The aim of the work of the Scott Agricultural Laboratories is to select the best trees for Kenya, and to discover the best means of propagating them, of cultivating them and of preparing the coffee. Thirteen trees now remain of the original selection. Four of these possess outstanding qualities of drought resistance, the remainder exhibit consistently well-shaped bean coupled with good liquoring qualities. Among other individual tree recording operations are :—100 trees of Jackson's coffee on the multiple stem system, 25 trees in the experiment laid out to observe the extent to which variability is controlled by different methods of propagation, open pollinated seed, selfed seed, cuttings, graft or seedling stock, grafts or clonal stock. There are variety trials on broader lines than individual tree recording and with these are included two single and multiple stem pruning and shade and no shade trials. Two methods of treating cuttings with root-promoting substances are still under experiment. The first is the standard method of placing the freshly cut ends of the plant material in the solution for a given period, the second is the vacuum chamber method by which the vapour is drawn out of the plant tissues in a vacuum containing growth solution, which enters the plant tissues when the vacuum is reduced. Cuttings from a single clone when set under coloured glass resulted in the number of cuttings rooting under yellow glass being 4 times greater than under clear glass. Blue, green and red light was also used with inferior results. A seedling mountain pawpaw (scientific name not given) made 12 inches more growth in 6 months under yellow glass than another seedling of the same variety under clear glass. Cuttings with a large leaf area root more successfully than those with leaves in part removed. Grafted trees suffered, if anything, less from drought than ungrafted trees and had a tendency to produce more secondary growth, thus the graft union can have little restricting effect on sap flow. No advantage was gained by treating scions with plant hormones when grafting. An experiment on size of planting hole has been laid out, the sizes ranging from 2 inches each way, including depth, to 18 inches. Indications in a replanting experiment so far are that young seedlings planted in a completely cleared block are more robust, much less susceptible to hot and cold disease but less tall than seedlings interplanted among old coffee. An experiment is in progress to determine whether speed of germination of seed is any indication of ultimate yield of the tree. In cultivation experiments full mulch gave superior growth over alternate row mulch and box ridging, the latter being the poorest. The crop was not recorded. In a spacing experiment with trees capped at 3 different heights the smallest number of trees per acre, 9' x 9' square, gave a bigger crop than approximately double the number of trees at 7' x 7'. There are a number of pruning experiments in which 4 systems are concerned. There was some loss of quality in coffee from heavily sprayed bushes, which is provisionally attributed to overcropping, these bushes averaging over 6 years nearly 3 times the crop of the unsprayed blocks. A system of preparation of coffee under water has been devised which achieves

uniformity of result for the hundreds of samples prepared for liquoring in connexion with the recording of individual trees.

1180. NYE, G. W.

633.73

Some results from Bukalasa experiment station.

E. Afr. agric. J., 1940, 5 : 460-5.

The results of some experiments with robusta coffee just within (10 miles) the northern limit of robusta cultivation in Buganda are discussed. The experiment plots were established in 1929. The single stem system proved superior to the multiple stem. Bananas could not be maintained as shade and *Gliricidia* proved unsatisfactory in growth and from the fact that it harboured mealy bug which dropped from the trees on to the coffee bushes. After 5 years of biennial bearing the trees had to be stumped, so that yields will be low until the stumped plots have fully recovered. Unshaded coffee yielded better than when shaded with *Gliricidia* or banana. Clean weeding gave increased yield and more regular yield over permanent cover crops, but the latter recently began to show improvement. Cropping is most regular under *Gliricidia* shade and more irregular under bananas than with no shade at all. Differences between annual mulching to a depth of 1 foot and clean weeding were not significant, but both are significantly better than weed cover and cover crop, and the cover crop is significantly better than weed cover. Mulch had a marked effect on reducing leaf fall, in soil conservation and reduction of weeding costs, but little, so far, in increasing yield. The yearly application of a petrol tin full of rotted cotton seed per tree gave a significant yield increase.

1181. FENWICKE-CLENNELL, C. E.

633.73-1.542

Musings on multi-stem coffee.

Mon. Bull. Coffee Bd Kenya, 1940, 6 : 52-3.

The author, who has changed from single stem to multiple stem coffee on his farm with improved results, contributes some notes on the change. Yield has increased because (a) pruning can be done more quickly and when the farmer chooses, (b) less cherry need be picked to obtain one ton of coffee than before. The reason for (b) is uncertain. Evidence is given to show that the multiple stem method is more drought-resisting than the single stem. Other advantages are greater ease of mechanical cultivation, the possibility when the contours require it of ploughing on the diagonal on coffee planted 8 ft. x 8 ft. and so reducing sheet erosion, the possibility of using disc harrows in front of the weeders, more efficient weeding since the absence of primaries overhanging the weeds permits the hoes to get in closer. There is, too, a great reduction of pruning costs since double the numbers can be pruned daily and that by any type of labour except the completely half-witted, so that there is no need to compete for the services of highly trained pruners, and, finally, there appears to be a reduction in pest attack. Several methods of converting the trees were tried and that which has proved most successful is, in the author's words, "Stumping at about 3 ft. 6 in. from the ground and establishing 4/6 bayonet heads at about that height; first taking a crop off the skirt left, then one off skirt and heads, finally removing all primaries and taking one or two crops off the bayonets while suckers proper are establishing themselves at the desired height from the soil."

1182. MELVILLE, A. R., AND JONES, H. N.

633.73-2.752-2.96

Progress report on the mealybug parasite project to March 1940.

Mon. Bull. Coffee Bd Kenya, 1940, 6 : 68-72.

Five species of parasites of mealy bug of coffee are being bred and liberated in the coffee districts of Kenya. Only one of these, *Anagyrus kivuensis*, has so far become partially established. The liberation, establishment and spread of this parasite to date is described for each district. Its life history is given and instructions for the preparation by planters of their farms for the survey that has to be undertaken when it is known that the parasite is breeding there. There is a discussion of the present position of the parasite in the field.

1183. NOTLEY, F. B.

633.73-2.73

Some further observations on coffee thrips.

Plant Chron., 1940, 35 : 135-40, bibl. 3.

From the evidence produced it is considered that thrips attack on coffee can be correlated with the occurrence of hot weather some weeks earlier. The critical temperature in Tanganyika

appears to be 27° C. occurring from September onwards and the earlier such a temperature is reached the more likely is an outbreak of thrips. By the middle of November it should be possible to tell whether an early outbreak and therefore probably a serious one is to be expected ; such a forecast should be modified as the season progresses. It should in this way be possible to forecast an outbreak three weeks to a month in advance. The outbreaks will first start in definite localized spots, i.e. on unshaded coffee on western slopes or behind windbreaks. These foci can be easily located during a thrips outbreak and by early treatment of such areas a general infection may be delayed or avoided.

1184. POUND, F. J.

633.74-1.4

The cultivation of cacao on loam soils.

A. L. Rhodes, Govt. Printer, Trinidad, 1939, pp. 31, 36c.

This is a popular bulletin intended for the cacao grower of Trinidad and Tobago whose estate lies on loam or sandy loam. A warning is given that treatment suggested there may prove quite unsuitable on other soil types especially as regards planting, pruning, draining and manuring. The reason for the bulletin is the urgent need for improved yields in Trinidad, if it is to compete with other countries where yields are higher and wages lower. The situation is the more difficult because the demand for the semi-fine Trinidad cocoas diminishes as manufacturers find methods of improving the flavour of inferior grades. The increases required, however, cannot be hoped for through improved cultivation though much may be done in this direction ; there must be a strenuous attempt to propagate high yielders by vegetative means and fortunately the island possesses a number of known trees which yield over 2,000 lb. of bean to the acre (instead of the usual 250-500 lb.). The material and methods differ from those of the past but it is only by their use that prosperity can return to the industry. As a result of their labours of the past 10 years the workers engaged in these investigations claim to have (1) discovered the vital factors which go to build up yield, (2) discovered the trees with those factors ; (3) discovered the means of propagating them ; (4) revolutionized the method of planting them ; (5) improved the method of maintaining them ; (6) brought productive efficiency into the cacao industry. It remains for planters to avail themselves of the opportunity.

1185. POSNETTE, A. F.

633.74 : 581.162.3

Self-incompatibility in cocoa (*Theobroma* sp.).

Trop. Agriculture, Trin., 1940, 17 : 67-71, bibl. 6.

This paper was submitted to the 3rd West African Agricultural Conference in Nigeria in 1938. The cocoa on Aburi Experiment Station has been tested for self-incompatibility, which is found to be least common in the Amelonado and most common in the Cundeamor, with Criollo intermediate. The influence of self-incompatibility on yield is discussed and supported by yield figures of plots and individual trees. The scarcity of self-incompatibility in the cocoa commercially grown in West Africa may help to account for the yields so greatly surpassing those of the West Indies. The effect of age on incompatibility is discussed. From various pollination experiments it is concluded that self-incompatibility is due to the inhibition of growth of the pollen tubes. Compatible pollen tubes may be inhibited also by the influence of incompatible tubes growing on the same stigma. [Author's summary.]

1186. EVANS, G.

633.74-1.535

Notes on the vegetative propagation of cacao at Kew.

Kew Bull., 1940, 1 : 42-4.

A method of rooting cacao cuttings of a smaller type than those rooted by the Trinidad method is described. The cuttings are required by the Royal Botanic Gardens, Kew, for sending abroad to the cacao growing colonies in order to establish superior varieties, chiefly in West Africa. The smaller cuttings are preferred, since shipping space is limited and a much greater number of them can travel in a Wardian case.

1187. GIESBERGER, G.

633.74-1.535

Eenige opmerkingen over het stekken van cacao. (Some observations on propagating cacao from cuttings.)

Bergcultures, 1939, 13 : 1732-4, bibl. 4.

These notes mainly serve to confirm the work of Pyke (1st, 2nd, 3rd *A. R. on Cacao Research*, Trinidad 1931-3 ; *H.A.*, 2 : 62, 3 : 399, 4 : 453-5). No increased success was obtained by the use

of heteroauxins, on the other hand some loss was caused since the leaves of treated plants often yellowed and dropped and without leaves the cuttings will not root.

1188. POUND, F. J.

633.74-1.8

Manurial experiments on cocoa in Trinidad and Tobago.

Publ. Dep. Agric. Trinidad and Tobago, being submitted to Cocoa Subsidy

Board as a report for the year ended 31 August 1938, 1940, pp. 102.

In this 3rd report the results of many new experiments on the manuring of cacao in Trinidad and Tobago are discussed. The more important findings are as follows: It has been clearly demonstrated that the value of pen manure to cacao lies in its carbohydrate, potash and phosphate content and that the nitrogen in it may be detrimental to shaded, though it may be beneficial to unshaded, cacao. The full benefit of manuring is obtained only from trees in good condition. Though poor trees may improve it is rarely economical to attempt this by manuring at present cacao prices (6-8 cents per lb.). The experiments are arranged under 8 soil type headings with separate heads for Toco and Tobago. Very briefly the recommendations are:—1.—*Black marl* (Princes Town). Superphosphate at 600 lb. per acre intermittently or followed by annual applications not exceeding 200 lb. per acre. Nitrogenous fertilizers decrease yield and if applied with superphosphate destroy much of the good effect of the latter. 2.—*Calcareous clays*. Rough forking with pen manure broadcast at 20 tons per acre, drains 18 inches to 2 feet deep, spaced 28 feet apart, the soil to be thrown over the pen manure on the beds to make them slightly turtle-backed. Nicifos IV, 1 part to sulphate of potash 6 parts by weight spread at 250 lb. per acre may be added. 3.—*Gypseous Brasso clays*. So far no manurial treatment has increased yields on this soil type. The C/N ratio is low and experiments to increase this (sugar is suggested) are in progress. The soil is not infertile compared to some but trees are short lived economically, especially in districts where calcium is present as sulphate, which crystallizes out in layers forming a suitable slip plane for landslides. 4.—*Acid clay alluvium*. Soluble phosphates as superphosphate at 300 lb. per acre have proved beneficial. Sulphate of ammonia and potash were ineffective. *Heavy loam* (Sangre Grande-Oropouche district). Superphosphate 300 lb. per acre annually may be beneficial, as may lime at 5 tons or less per acre as a long range speculation. Neither pen manure nor forking has been useful. Spraying against thrips attack, which is often severe, appeared to increase yield. *Sands and silts* (Moruga). Here the sands and silts appear to have reverse requirements. A general guide is to apply potash at 600 lb. per acre followed by smaller annual applications, if the potash content of the surface 6 inches is less than 60 parts per million, and highly soluble phosphates at the same rate if the phosphate content is less than 30 parts per million. 7.—*Manzanilla loams*. These resemble Moruga sands and silts in many respects and are variable. Yields of 1,000 lb. of cured bean per acre have been built up by careful cultural work followed by constant applications of sulphate of potash and superphosphate each at 300 lb. per acre. Liming is probably profitable at long range. Nitrogen is harmful. 8.—*Medium to sandy loams*. Reasonably heavy pruning followed immediately by bedded or lightly forked pen manure at 20 tons per acre with an initial dressing of 600 lb. sulphate or muriate of potash plus 300 lb. superphosphate and annual dressings of the same fertilizers at $\frac{1}{4}$ to $\frac{1}{3}$ the initial rate. *Toco soils*. Calcareous schist responds best to heavy potash applications and quartz schist to soluble phosphates. The igneous rock soils require no fertilizers. *Tobago*. The chief types are divided into 3 sections and recommendations are made. All the experiments leading to the above recommendations are discussed in detail in the report.

1189. VOELCKER, O. J., AND WEST, J.

633.74-2.8

Cacao die-back.

Trop. Agriculture, Trin., 1940, 17: 27-31, bibl. 8.

The probable causes of die-back of cacao are discussed. It is a problem common to most cacao countries and one in which theories are plentiful and experimental evidence small. The author summarizes the theories prevalent in various districts and produces his own for Nigeria and the Gold Coast. In Nigeria 3 primary causes are recognized, (1) Drought through lack of soil moisture. (2) *Sahlbergella* blast, a disease caused by *S. singularis* and/or *S. Theobroma*. (3) Unsuitability of the soil. On the Gold Coast drought and *Sahlbergella* are considered as causing die-back in the drier and wetter areas respectively.

1190. POSNETTE, A. F. 633.74-2.8
Transmission of "swollen shoot" disease of cacao.
Trop. Agriculture, Trin., 1940, 17: 98.

It has been found that swollen shoot disease of cacao on the Gold Coast can be transmitted by budding. A noteworthy feature has been the high mortality of the infected scion buds and the rapid killing of the healthy stock after budding. The symptoms are:—in 6 weeks to 2 months from budding intravascular leaf chlorosis; withering of young leaves immediately after breaking from the bud leaving a green leafless shoot with persistent stipules; dieback of axillary buds as they shoot in pairs or threes down the stem; and finally, 5-8 months from budding, a typical swelling of the main axis which is the final symptom. The evidence of transmissibility suggests that the disease is a virus.

1191. POUND, F. J. 633.74-2.4
Witches' broom resistance in cacao.
Trop. Agriculture, Trin., 1940, 17: 6-8.

A brief discussion of the possibility of establishing a strain of cacao resistant to witches' broom disease (*Marasmius perniciosus* Stahel) from information and material gathered by the author during a tour of South America in search of resistant types. In fact groups of uninfected trees growing and bearing freely in the midst of heavily infected plantations were located as well as large districts completely free from the disease. Questions that require study are the resistance of some varieties only in open spaces, probably due to the more rapid hardening of the young plant tissues through which alone the disease can gain entrance, the effect of altitude as an ecological factor inimical to the fungus, and whether types uninfected even under shade are completely immune or, as in Ecuador, merely highly resistant. More will be known when the seedling progeny of these trees planted in Trinidad in 1939 are old enough to study.

1192. BETREM, J. G. 633.74-2.754: 632.951.1
 Derrispoeder als middel ter bestrijding van de *Helopeltis* in de cacaocultuur.
(Derris powder for combating *Helopeltis* in cacao cultivation.)
Bergcultures, 1940, 14: 134-54.

The possibility is shown of effective control of *Helopeltis* on bearing cacao in Java by dusting with derris powder having a rotenone content of 3-4%. The after-effects on the *Helopeltis* population is so small that an interval of 14 days is the maximum that should be allowed between dustings. From 4 to 6 dustings will be required. Coarse or uneven samples of derris dust are probably of little use. An increased yield of cacao was obtained from the dusted trees in the experiments described. Some interesting facts are brought out in the discussion which followed the reading of this paper.

1193. BREGMAN, A. 633.841
 De pepercultuur en-handel op Bangka. **(Cultivation and trade of pepper**
(*Piper nigrum*) on the island of Bangka.) [English summary $\frac{1}{2}$ p.]
Landbouw, 1940, 16: 139-256, bibl. 17.

An instructive paper dealing very fully with the cultivation and trade in pepper on the island of Bangka, Dutch East Indies. The methods of cultivation and manufacture, chiefly of white pepper, which are described, are mainly those of the Chinese. Manual experiments and problems come in for a good deal of attention in this paper. Pests and diseases and their control are briefly discussed.

1194. MEIJER, T. M., AND VAN HULSEN, C. J. 633.85
 Tea-tree olie in Nederlandsch-Indië. **(Tea tree oil in the Dutch East Indies.)**
Bergcultures, 1940, 14: 354-5, bibl. 12.

The article is concerned with the possibilities of growing the Australian tea-tree oil *Melaleuca alternifolia* in the Dutch East Indies. As far as it has been yet tried in Java it appears to grow well above 3,000 feet. A good rainfall is an advantage, but it has not done badly in regions with a pronounced dry season. The analysis of oil from these trees can compare favourably with the analysis given for Australian oil by Penfold (*Perf. ess. Oil Rec.*, 1934, p. 374) from whose writings most of the material in the article is taken.

1195. SVESHNIKOVA, M. 633.88-2.651.3

Root-knot nematode on *Areca rubra*. [Russian.]

Soviet Subtropics, 1940, No. 4 (68), pp. 45-6.

This is the first recorded incidence in U.S.S.R. of root-knot nematodes, *Heterodera marioni* C. in root collar and stem of a plant. It is thought that the spread of the nematodes on the plant may have been facilitated by *Rhizoglyphus echinopus* Fet R. found on the same plant.

1196. FARIA, D. de C. 633.88.32.491

A mamona sob o triplice aspecto cultural, industrial e econômico.

(The castor oil plant, its cultivation and uses.)

Ministry of Agriculture Rio de Janeiro, Brazil, 1939, pp. 57, bibl. 18.

The cultivation of the castor oil plant (*Ricinus communis*) in Brazil is described and the present position in commerce as regards Brazil is discussed. The crop is grown from seed sown in the field, 2 or 3 seeds to a hole, the strongest seedling being retained, or sown in nurseries and transplanted if on a smaller scale. Sufficient hoeing to keep the weeds in check is given, the first being when the seedlings are thinned out. Earthing' up, or drawing the earth up to the stem at the time of hoeing reduces evaporation and provides some support against wind. Pruning consists of topping the young plants, followed by a second cut later, the object of which is to produce a dense bushy head which will smother weeds and give the tree a convenient shape for harvesting. Irrigation is important. Although the plant is often described as drought-resistant undoubtedly the crop is greatly reduced by lack of sufficient moisture. It is ready 270 days after sowing and several pickings are made beginning with the lower capsules which ripen first; there appears to be a well-founded belief that these seeds have a greater oil content and more vitality than those ripening later. Seeds are generally picked three-quarters ripe and dried, the drying causing the capsules to open and release the seed; for this reason it is desirable to grow varieties which dehisce easily. Drying is followed by hard threshing to free any seeds still in the capsule and by sieving or mechanical winnowing to remove the husks.

1197. TROMP, P. H. M. 633.91

Cultuurgegevens betreffende *Amorphophallus oncophyllus* Prain. (Notes on the cultivation of *Amorphophallus*.)

Landbouw, 1940, 16: 63-71.

There are a number of *Amorphophallus* species and varieties but only one of commercial importance in the Netherlands Indies, namely, *A. oncophyllus* Prain. From the tubers of the last named is prepared a meal which has the property of dissolving in cold water into a kind of gelatine which is used industrially for such purposes as coagulating latex, dressing in textiles, water proofings, awnings, umbrellas, etc. Two other species of mainly local importance, *A. campanulatus* Bl. and *A. variabilis* Bl., are briefly described and distinguished from *A. oncophyllus*. Propagation of the latter is by seed or vegetatively. The two or three seeds must be freed from the berry; and provided they are not left in the sun they will remain viable for 2-4 months without germinating. After that period they begin to germinate. They can be kept, if necessary, in this stage for a few further weeks before being sown in beds of sandy soil under light shade. When the rainy season starts the seedlings can be set out at 15 × 15 cm. into nursery beds in rich soil and the following year can be used as planting material. Vegetative propagation is achieved by bulbils which form on the leaf veins and can be collected at the end of the west monsoon when the leaves die back. From 1 to 40 bulbils per leaf are produced, according to the size of the plant, in all sizes up to 6 cm. Those over 1 cm. are planted in their permanent positions, those under 1 cm. are sieved out and planted separately in nursery beds. Sections of older tubers can also be used as planting material if bulbils are scarce. They are cut in October, gently dried on gauze trays in the shade and planted in the field in November, spacing, as for the bulbils, being 50 × 50 cm. Soil plays a great part in yield, which may be anything from total failure to 100-fold increase; normally however a 5 gram bulbil will produce a tuber of 200-300 gm. in the first year. It is impossible to foretell without a preliminary trial whether any given site will prove successful. The plant, however, is very susceptible to drought. The crop needs light shade such as provided by *Leucaena*, but how far it will succeed as a catch crop under rubber, kapok, etc., is not known. Cultural care consists only in an occasional hoeing.

The tubers must be lifted before the plant flowers, which may be in the 3rd, or even 4th, year. If the price is high they are lifted after one vegetative cycle, but if poor they are left a further year, by which time the 300 gram tuber of the first season should weigh from 1 to 3 kg. In conclusion some account is given of pests and diseases.

1198. COLENBRANDER, G. H. 633.912-1.532
 Het splitsen van *Hevea*-kiemplanten. (**Twining *hevea* seedlings.**)
Bergcultures, 1940, **14**: 84-5.

Bisecting germinating *Hevea* seedlings longitudinally and thereby obtaining two plants from one seed is a method which is worth while with expensive pedigree seed. The germinating seed is cut through with a safety razor blade. The best condition is when the emerging rootlet is not more than 2 or at most 3 cm. long and the tap shoot is still bent between the cotyledons. The two halves are not taken at first apart but are planted together. At one time a piece of paper soaked in bordeaux mixture was inserted between them to prevent them fusing, but it has been found unnecessary for either root or top. It is essential that the young seedlings should be shaded for a considerable time, a critical period especially being when the twins have exhausted the nutriment in their single cotyledons; this occurs when the aboveground portion is about 12 cm. long. Planting in shaded beds is very much more successful than planting in baskets since soil moisture is easier to maintain. At nine months there was no visible difference in size or vigour between the twinned plants and those grown normally.

1199. WHELAN, L. A., AND DE SILVA, C. A. 633.912-1.8
Field experiments on Dartonfield Estate. XI. Manuring experiment with mature rubber (1939).
Quart. Circ. Rubb. Res. Sch. Ceylon, 1940, **17**: 14-8.

The yield, growth and bark renewal records for *Hevea* in a manurial experiment proceeding with annual applications since 1936 are summarized. The fertilizer treatments were N, NP, NK, NPK and no manure, applied at the rate of $N=P_2O_5=K_2O=0.4$ lb. per tree. The responses in yield to the manures, when compensation has been made for the initial differences shown by the uniformity trial of 1936, are not significant, though the manured plots are slightly the better. There was again an indication, noticed in a previous year, that phosphate without potash added to a nitrogenous manure depresses yield. There is a slight apparent depressing effect of phosphate on dry rubber content. There has been a very poor response in girth increment to manuring since the experiment started nor are the responses in bark renewal significant.

1200. RUBBER RESEARCH INSTITUTE OF MALAYA. 633.912-1.8
Manuring programme for replanted and mature rubber trees.
Circ. Rubb. Res. Inst. Malaya **1** (revised), 1940, pp. 3.

This circular tabulates recommendations for time of application and amount of fertilizer, the mixtures to be used for different soil types and the method of application for seedlings, bud grafts, basket plants and budded stumps at a series of ages ranging from 3 months to 30 years. The table is supplemented by advisory notes in which are embodied suggestions resulting from data obtained in current research.

1201. RUBBER RESEARCH INSTITUTE OF MALAYA. 633.912
International notation for tapping systems.
Circ. Rubb. Res. Inst. Malaya **12** (revised), 1940, pp. 3.

A desk card stating in abbreviated form the essentials of the international notation for tapping systems. The notation eliminates the commonly used local terms for the many tapping systems, most of which terms fail adequately to indicate the nature of the system, and substitutes a standard series of letters and figures each with a definite meaning, which will be crystal clear to planters of all countries, while leaving the layman in a denser fog than ever. The old Malayan terms are here arranged side by side with their international equivalents. The method adopted in this new notation is briefly explained. The full revised notation is set out in Communication of Journal of R.R.I.M. No. 247, Vol. 10, pp. 26-33 and a full explanation of the basis of the notation and reasons for the recent revision in communications Nos. 239 *ibidem* Vol. 9, pp. 142-63 and 246 *ibidem* Vol. 10, pp. 16-25.

1202. RUBBER RESEARCH INSTITUTE OF MALAYA. 632.187 : 633.912-1.556.8
Drought and fire damage. Heat and sun-scorch of the tapping panel and seedlings.

Circ. Rubb. Res. Inst. Malaya 11, 1940, pp. 2.

The stems of young rubber and the tapping panel of older rubber are often scorched by fires from various causes, from lack of shade on the tapping panel owing to seasonal leaf fall, and in the case of young seedlings from sun heat reflected from sandy soil in dry weather, especially where the settling of the soil leaves a concave surface round the stem which focuses the sun's heat on the stem of the plants 1" to 4" above ground level. Treatment for scorch by fire consists of scraping off the charred bark, this being attractive to boring beetles, and spraying with one of a number of water-miscible fungicides of which a list is given. On the following day whitewash the bole using 3 lb. slaked lime to 1 gallon water. Sun scorch of tapping panel may be treated similarly without scraping. A new alternative method is to treat the tapping panel with palm oil at weekly intervals to prevent excessive evaporation. Stem base rot can be prevented by shading the base of the plants with grass cuttings, etc., and seeing that the soil is level or convex round the stems. Withering at transplanting can be avoided by previous preparation of the plants by gradual removal of shade from the bags some weeks beforehand.

1203. POTTER, T. I. 634.1/8
Fruit. Native and imported.

Proc. agric. Soc. Trin. Tob., 1939, 39 : 337-42, 364-8, 475-500, bibl. 5.

The paper contains much information on the native and introduced fruits of Trinidad and Tobago. The author has covered the field very thoroughly and there can be few, if any, omissions. The local notes are of interest.

1204. RAKTAKANISHTA, X. 631.4 : 634.433 + 634.669 + 634.653
The influence of different soil media on the rate of growth of certain kinds of fruit plants.

Philipp. Agric., 1940, 28 : 681-91, bibl. 6.

The seeds of star apple (*Chrysophyllum Cainito*), lanzon (*Lansium domesticum*) and avocado were planted in seed boxes and allowed to germinate and grow for 6 months. Only seedlings of normal appearance were then selected for experiment. They were removed and had their roots washed to remove as much soil as possible, weighed and planted in pots containing one of 6 soil media, namely clay loam, river sand, $\frac{1}{4}$ clay loam and $\frac{3}{4}$ river sand, $\frac{1}{2}$ clay loam and $\frac{1}{2}$ river sand, $\frac{2}{3}$ clay loam and $\frac{1}{3}$ river sand, and compost of well decayed and sieved soybean vines. The pots were kept in the shade inside the nursery for about a month and then transferred outside in diffused sunlight, in the shade of bamboo, where they stayed until the end of the experiment. Height and girth measurements were taken fortnightly and weights were taken at the end of the trial [apparently about 390 days from planting out]. Of the three kinds star apple recovered most quickly from transplanting, lanzons next and lastly avocados. Lanzons and star apples grew fastest in compost, avocados very slightly faster in $\frac{1}{2}$ clay loam and $\frac{1}{2}$ river sand. These results were not, however, significant. In all cases the seedlings grown in compost were apparently most healthy. Star apples grew fastest, avocado next and lanzons last in the ratio of 5.1 : 2.2 : 1.0. Results show that growth depends not only on the chemical but also on the physical condition of the soil and that compost is a good growing medium for the three plants tested.

1205. SINGH, LAL, AND KHAN, A. A. 634.441 : 581.14
Relation of growth to fruit bearing in mangoes.

Ind. J. agric. Sci., 1939, 9 : 835-67, bibl. 25.

The paper discusses the investigations at Lyallpur from 1932 to 1938 on the relation of growth to bearing in mangoes. The methods employed in the investigation are described. The shoots that intended to flower the following season and those that did not showed marked differences in growth periodicity. Those that flowered the following year had made marked growth early in the season previous to flowering and ceased growing about a month earlier compared with shoots that did not flower in the following spring. During the growing season fruiting and vegetative growth were always at the expense of each other. There was a direct relationship between the number of shoots growing in one season and the number of shoots flowering in the

subsequent spring. There was a tendency to alternate (or biennial) bearing on individual shoots. The causes of on and off years in mangoes throughout the mango tracts where the trees are of all ages are also discussed and attributed to external factors such as frost or pests and diseases disturbing the equilibrium of the trees. Fruit bud initiation took place only on shoots one season old. The highest yield came from flushes initiated early in the previous season. When deblossomed early in the season shoots resumed vegetative growth and bore the next season in the same way as shoots which did not flower.

1206. CONDIT, I. J.

634.57

The macadamia, or Queensland nut.

Reprinted from *Diamond News*, March 1940, pp. 3.

The author, who is associate professor of subtropical horticulture at the Citrus Experiment Station, Riverside, discusses the possibility of the successful growing of *Macadamia ternifolia* as a commercial crop in California as in Hawaii. Regarding vegetative propagation the results obtained at the Hawaii experiment station are quoted :—(1) cuttings may be rooted but with difficulty ; (2) air layering takes 30-60 days ; (3) inarching is difficult and slow ; (4) the side-tongue graft has given far the best results so far ; (5) successful topworking of established trees is not difficult. In California existing trees, of which there are a fair number of old established specimens, will resist light frosts and withstand neglect that would be very detrimental to citrus or avocado. Wind damage is frequent. Grafted trees bear after 6-7 years in the orchard whereas seedlings are erratic as to time of first bearing. Trees which failed to bear properly have been brought into heavy production by girdling. The yield may be from 36 to 70 lb. of husked nuts per annum for trees from 7 to 10 years old. The type of nut desired by Hawaii growers is large, uniform and smooth, containing about 76% of oil and 8% of sugar. The importance of a thin shell has receded since the introduction of mechanical shelling. In conclusion it is considered inadvisable to grow *Macadamia* commercially in California at the moment, since a large outlay of capital would be needed. Hand shelling of the nuts is impracticable so that large plantings would be necessary to make the purchase of machinery worth while.

1207. SOYER, D.

634.58-2.8

La "Rosette" de l'arachide. Recherches sur les vecteurs possibles de la maladie. (**Vectors of rosette in groundnut.**)

Publ. Inst. nat. Étude agron. Congo belge (I.N.E.A.C.), *Sér. tech.*, 21, 1939, pp. 23, bibl. 13, 11 francs.

Of five insects which live on the plant only one, *Aphis laburni* Theob., was found capable of spreading groundnut rosette in the Belgian Congo. Attempts to inoculate local plants by means of this insect were successful in only one case, namely that of *Centrosema Plumieri*, but all attempts to reinoculate from *C. Plumieri* failed. Losses from this virus, which generally produces a chlorotic stunted effect on the groundnut plant, may amount to 80-90% of the crop. It is found that the creeping varieties are most susceptible and that second season are more susceptible than first season plants. The best control methods are as follows :—sow very thickly and delay hoeing, avoid planting two successive plants of groundnut, destroy any old plants which show new growth and use resistant varieties.

1208. MABBUN, P. N., AND BAES, R. P.

634.669

A study of the marketing of lanzones in Laguna.

Philipp. Agric., 1940, 28 : 656-80, bibl. 6.

The essence of this article is of more local than general interest. It contains, however, references to articles on lanzon (*Lansium domesticum*) improvement and the industry in the Philippines. It may also be noted that, although the lanzon occupies only the tenth place as regards area under cultivation, it is third in money value of the leading fruit crops in the Philippines, being exceeded only by bananas and mangoes.

1209. CROUCHER, H. H., AND MITCHELL, W. K.

634.771-1.8

The use of fertilizers on bananas.

J. Jamaica agric. Soc., 1940, 44 : 138-42.

The article is a summary of results of experiments conducted by the Jamaica Department of Agriculture. The fact is stressed that the composition of the fertilizer is determined mainly

by the soil in which the bananas are growing and that fertilizers not properly related to the composition of the soil may even decrease the yield. A summary of the recommendations is:—

1. For soils containing ample available potash and phosphate apply per root 3 oz. sulphate of ammonia or its equivalent every 6 weeks or every 4 weeks if nitrate of soda is used.
2. For soils containing little available potash but ample available phosphate 3 oz. sulphate of ammonia every 6 weeks; $\frac{1}{2}$ lb. sulphate of potash every 6 months.
3. For soils containing little available phosphate but ample available potash 3 oz. sulphate of ammonia every 6 weeks; $\frac{1}{2}$ lb. superphosphate 16%-18% w.s. P_2O_5 every 6 months.
4. For soils containing medium to high amounts of available phosphate but medium to low amounts of available potash $\frac{3}{4}$ lb. of a mixture containing 6% N, 6% P_2O_5 , 18% K_2O applied every 6 months with intermediate 6-weekly applications of 3 oz. sulphate of ammonia or 2 oz. nitrate of soda every 4 weeks.
5. For intermediate soils containing a medium to high amount of phosphate $\frac{3}{4}$ lb. of a mixture containing 5% N, 10% P_2O_5 , 10% K_2O , with intermediate applications at 6-weekly intervals of 3 oz. sulphate of ammonia.

1210. SIMMONDS, J. H., AND MITCHELL, R. S. 632.48 : 634.771

Black end and anthracnose of the banana with special reference to *Gloeosporium Musarum* Cke. and Mass.

Bull. Coun. Sci. industr. Res. Aust. **131**, 1940, pp. 63, bibl. 46.

Under Queensland conditions much the most important organism associated with black-end in bananas is *Gloeosporium Musarum*, *Nigrospora sphaerica* and *Fusarium* spp. being less important. The fruit is contaminated while still in the plantation. Climatic factors, temperature and humidity are largely responsible for the high incidence during the summer. Dead leaves on the plant were found to contribute very greatly to black-end development. Attempts at control by fungicides in the field were not successful nor was fumigation of fruit with formaldehyde, chlorine or sulphur dioxide. Immersion in a solution of Shirilan A.G. was moderately successful. It is concluded that black-end can be controlled only by close attention to a number of points closely bound up with plantation management, transport and ripening, and recommendations are made on these lines.

1211. BAKER, K. F., AND COLLINS, J. L. 634.774

Notes on the distribution and ecology of *Ananas* and *Pseudananas* in South America.

Reprinted from *Amer. J. Bot.*, 1939, **26** : 697-702, bibl. 6.

Evidence is presented that *Pseudananas* and most species of *Ananas* are native to that area of S. America between latitude 14°-29° S. and east of 59° W. longitude. The botany of much of the area is practically unknown.

1212. TRAUB, H. P., COOPER, W. C., AND REECE, P. C. 634.774 : 581.145.1 : 547.313.2

Inducing flowering in the pineapple, *Ananas sativus*.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, **37** : 521-5, bibl. 19.

It was found possible to induce out of season flowering in pineapple by exposure to ethylene gas both in chambers indoors and in the field in Palm Beach County, Florida.

1213. BURNS, W. 634.775.4

The future of spineless cactus in India.

Indian Fmg. 1940, **1** : 160-1, bibl. 1.

Spineless cactus has proved a useful emergency feed for stock in times of famine in India and it is strange that it is not more grown. It is unaffected by the cochineal insect *Dactylopius tomentosus* which destroys the common prickly pear (*Opuntia elatior*). There is more than one spineless cactus. That referred to in the article appears to be *decumana*. To propagate it single joints of the cactus are placed upright against the furrow and covered so that half the cactus is under ground. Planting distance is 3 feet apart in rows 10 feet apart which means 1,500 cuttings per acre. Planting should be done in dry weather but not if there is danger of

frost. With very dry soil a single watering in a furrow a foot away from the rows is beneficial. A suitable rainfall is 30 inches, but 10 will suffice. When required as feed the cactus can be passed through a chaff cutter, and mixed with 6 lb. of cotton seed or other dry feed per 100 lb. of cactus. The technique of feeding prickly pear has been thoroughly worked out in several successive famines and the results are embodied in *Bull.* 97 of the Bombay Department of Agriculture 1920.

1214. DEPARTMENT VAN ECONOMISCHE ZAKEN, DIENST VAN DEN LANDBOUW, BUITENZORG. 083:63
Liest van mededeelingen van het algemeen proefstation voor den landbouw 1912-1939.

(List of publications of the general agricultural experiment station 1912-1939.) Archibel Drukkerij, Buitenzorg 1939, pp. 12.

MULLER, H. R. A. 634.441-2.4 + 2.19
Overzicht van de belangrijkste mangga-ziekten in Nederlandsch Indië. (**The principal mango diseases in Dutch East Indies.**) [English summary.] *Landbouw*, 1940, 16:13-21, bibl. 14. Abstracted as *Meded. alg. Proefst. Landb.* 40, H.A. 10:706.

MAHER, C. 625.71:631.4
Roads and their relationship to soil conservation.
E. Afr. agric. J., 1940, 5:425-34.

STORAGE.

1215. PAECH, K. 664.85.037 + 664.84.037
Pflanzenphysiologische Grundlagen der Kaltlagerung von Obst und Gemüse. (**Physiological principles of low temperature storage of fruit and vegetables.**) *Forschungsdienst*, 1939, 8:231-56, bibl. 38.

This is a review of literature, largely English, on cold storage of fruits and vegetables. It appears that little original work has been done in Germany. Notes appear on:—1. Respiration of fruit during storage. 2. The relationship between temperatures and respiration. 3. Other factors affecting the rate of respiration of fruits during storage. 4. Pectin changes in fruits and softening of fruits. 5. The emanation during storage of volatile substances other than CO₂ and the effect of ethylene on the ripening process. 6. Cold storage diseases. The following points may be noted:—The approximate freezing points were determined for the juice of apples, pears, plums, grapes, cherries, strawberries, raspberries, currants and bilberries. For all of these juices as well as for most vegetable juices it lies above -2° C. and -3° C. The average freezing points do not represent constant values, as they vary according to water content and chemical composition. Hence, to avoid injury of cell tissue fruits should be stored at temperatures somewhat higher than the freezing point temperatures established. In the case of onions experience has shown that a storage temperature of -2.5° C. is preferable. It was also found that partial freezing of the juice has no unfavourable effect on brussels sprouts. Tomatoes picked green and stored at 10° C. were unable to carry on their normal respiration processes. Potatoes stored for any length of time at 0° to $+3^{\circ}$ C. were found to accumulate sugar and to increase their rates of respiration very considerably on a subsequent transfer to higher temperatures. Their rate of respiration only fell to normal as the sugar was gradually used up. German experiments indicate that the absolute content of HCl soluble pectins stands in direct proportion to the firmness of stored fruits (pears and tomatoes). In the course of investigations of low temperature breakdown an interesting observation was made in Germany. On comparing the respiration ratios of fruits of a variety highly susceptible to breakdown (Osnabrücker Reinette) with those of a variety non-susceptible to breakdown (Berlepsch Reinette) it was found that the respiration ratio of the fruits of the former—which later showed breakdown—was >1.0 at 0° C., whereas the ratio for Berlepsch Reinette fruits at the same temperature was <1.0 .

1216. CRUESS, W. V.

613.2 : 634.1/8

The dietary value of fruits and fruit products.*Fruit Prod. J.*, 1940, 19 : 230-3, 245, 247, 251, bibl. 50.

The paper claims to be largely a résumé of research conducted in recent years at California University on the dietary value of fruits and fruit products. Some findings in connexion with particular fruits are given below. Prunes are a valuable source of vitamin A and G (riboflavin) and, contrary to common belief, do not reduce the alkaline reserve of the blood or the pH value of the urine. The laxative action of prunes is due to a specific water-soluble compound. For haemoglobin regeneration in simple anaemia apricots, peaches and prunes are far superior to dairy products. *Vitamin C*.—Oranges are rich in the anti-scorbutic vitamin C and practically no loss is caused by concentration of the juice to a heavy syrup or by dehydration of the fruit. Canned citrus juice after 9 months was found to contain as much C as fresh. The loss of C in stored orange juice runs closely parallel to the darkening of the juice. Apples lose all directly titratable C within a few minutes of pressing and commercially bottled apple juice is stated to have been practically useless as a source of C in guineapig feeding tests. Similar loss occurs in raw grape and tomato juice. Such loss was prevented by heating the fruit before pressing to a sufficiently high temperature to destroy ascorbase (vitamin C oxidase). Sulphuring by fumigation in many kinds of fruit prevented loss of C. Black currants grown in Great Britain contain 3 times the C content of orange juice, previously considered the best common fruit source. Canned fruits of many kinds including tomatoes retain C practically undiminished. The C content of several fruits, etc., expressed in Sherman units is approximately as follows:—apricots fresh 6, dried 20, avocado 18, banana 30, blackberry 6, black currants 200, cherries 20, cider 0, cranberry 25, dry dates 0, fresh fig 4, dried fig 0, grapes 3, grapefruit 52, orange juice 65, fresh peach 12, dried peach 50, pears 7, pineapple juice 20, dried prunes 0, quince 9, raspberry 35, strawberry 50, tomato 30 and tomato juice 0-30. *Vitamin A*.—The great variation in vitamin A between varieties of fruit is according to the amount of carotene present. The values in Sherman units are* apples 80, fresh apricots 5,400, dry apricots 7,000, banana 275, blackberry 200, carrots, young 3,000, carrots, mature 5,500, Royal Anne cherry 450, dry dates 140, grapes 0-25, grapefruit 0, canned ripe olives 100-250, orange juice 67, yellow peach 1,000, dried yellow peaches 4,500, white peach 5, pear 12, pineapple 250, and dried prunes 2,500. A is stable to heat, so that canned fruits are approximately equal to fresh. Filtering to give clear juices removes carotene. Earlier workers (in collaboration) found that in drying apricots 50% of A was lost but that sulphuring with SO₂ fumes before drying prevented this. *Vitamin B₁* (anti-neuritic). Fruits are not exceptional sources of B₁ according to some authors but Daniell and Munsell, whose Sherman figures have been quoted above, find considerable sources in some fruits. Their figures are apple 25, avocado 30, banana 30, cranberry 0, date 40, fig 35, dried fig 30, grapefruit 20, orange juice 50, pear 35, pineapple 50, and tomato 33. Frozen and pasteurized juices lose much B₁. There is considerable reference to the effect of wine making on the vitamins. The article continues with a discussion of the public health aspects of packed and canned fruit products.

1217. KISLIUK, M.

351.823.1 : 632.97

Some scientific contributions made at the port of New York.*J. econ. Ent.*, 1940, 33 : 374-9, bibl. 24.

An interesting note on the pests found in vegetables and fruits, on cotton and related plants, on nursery stock, plants and seeds, in packing material and in a number of other imported objects at the port of New York. The host and the country of origin are stated in all cases.

1218. PAGE, A. B. P., AND LUBATTI, O. F.

632.944

The principles of fumigation of insect pests in stored produce.

Department of Scientific and Industrial Research, London, 1940, pp. 28, 6d.

The authors confine themselves to general principles, illustrated occasionally by specific instances. They deal with:—(1) Chemical factors, viz. vaporization, distribution, penetration, construction of buildings and chambers, airing or ventilation, and residual fumigant. (2) Biological factors,

* Daniell and Munsell figures.

viz. identification of insects, temperature, the disturbing of insects, humidity, efficacy of fumigation. Single fumigations are not usually satisfactory and a system combining fumigation with spraying, dusting, etc., must usually be adopted.

1219. (i) CLAYPOOL, L. L. 664.85.038

The waxing of deciduous fruits.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 443-7.

- (ii) SMOCK, R. M. 664.85.11.038

Some additional effects of waxing apples.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 448-52, bibl. 6.

(i) Six hundred individual waxing tests were made at Davis, Calif., on a wide range of deciduous fruits in 1938 and 1939 using the water emulsion process. After waxing the fruit was stored at 45° F. for 10 days, after which it was removed to the ripening room at 67° F. with a relative humidity of about 85%. Benefit was found to be greatest in fruits with a thin cuticle, the apricot proving an exception. Economy favours the use of paraffin rather than a Carnauba wax despite the "dry bright" effect of the latter on such fruits as cherry and nectarine. Water loss in waxed lots of stone fruits was reduced to as low as 30% of the control without ill effects, whereas in pears a reduction of water loss to 50% of the control was found likely to result in abnormal ripening and inferior eating quality. Decay, although reduced in some cases, has not generally speaking been overcome by waxing.

(ii) Tests at Ithaca indicate that some wax emulsions have a slight retarding effect on the development of scald in certain apple varieties, while others have no, or even the reverse, effect. Wax prevents the loss of water, hence the result of holding apples in low relative humidity in store can be partially overcome by waxing. Whether a wax emulsion would affect scald development would appear to depend on the maturity of the fruit, the nature of the emulsion and its concentration. All those tested increased scald in very immature fruit. Two waxes seemed to inhibit the development of bitter pit in store, but the pit appeared afterwards on removal from store.

1220. HARVEY, R. B. 664.84.038

Waxing vegetables.

Minn. Horticulturist, 1939, 67: 173, being Pap. Misc. J. Ser., Minn. agric. Exp. Stat. 414.

Instructions are given for waxing small quantities of root vegetables for long storage. A one-inch layer of Parowax or paraffin wax used for sealing jelly glasses is floated on a large pail of water, 10-20% beeswax is added to toughen the paraffin wax. The bath is kept just below boiling point. The vegetables are carefully washed. If scratched the wax will not adhere to the peeled surface. The vegetables, placed in a wire basket for dipping, should be dry and of room temperature. Cold vegetables take on too thick a layer of wax, which should correctly be 1-3% of the weight of the vegetables. Storage must be just above freezing point. Most success is had with rutabaga, turnips, beets and parsnips. Kohl-rabi, sweet potatoes and carrots will keep longer waxed but require more care; i.e. sweet potatoes must be stored at 50° F., waxed carrots will balloon the film with respiration gases unless kept at low temperatures.

1221. (i) VAN DOREN, A. 664.85.11.035.1

Physiological studies with McIntosh apples in modified atmosphere cold-storage.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 453-8, bibl. 8.

- (ii) FISHER, D. V. 664.85.11.035.1

Storage of Delicious apples in artificial atmospheres.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 459-62, bibl. 6.

- (iii) BROOKS, C. 664.85.11.035.1

Effect of carbon dioxide treatment upon the rate of ripening in apples.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 463-6.

(i) Trial was made at Ithaca of several modified atmospheres for the storing of McIntosh apples and the physiological data obtained are discussed. The normal storage life was found to be

nearly doubled when the apples were stored in an atmosphere containing 5% CO₂ and 2% O₂ at 40° F. as compared with air storage at 32° F. Moreover brown core was eliminated.

(ii) In this trial at Ames, Iowa, in 1938-9, Delicious apples were stored at both 40° and 32° F. in the following atmospheres:—5% CO₂, 2.5% O₂; 0 CO₂, 2.5% O₂; 5% CO₂, 25% O₂; and air. All three atmospheres at 40° F. resulted in better flavoured fruit than that stored in air at 40° F. Both mixtures containing CO₂ tended to accelerate development of mealiness as compared with the CO₂-free gas mixture. The mixture without CO₂ and with 2.5% O₂ resulted in fruit of distinctly the best storage quality at both 40° and 32° F. and delayed the onset of mealiness.

(iii) Trial was made at Beltsville of exposing apples the day after picking to atmospheres containing a high percentage of CO₂ for 2 days at fairly high temperatures, i.e. >50° F. With the varieties tested, Stayman Winesap, Starking and Jonathan, 2-day exposure to 40% CO₂ at temperatures about 50° F. resulted in much greater delay in ripening than holding at 32° for 2 days without CO₂.

1222. MILLER, E. V., AND SCHOMER, H. A. 664.85.11 : 632.19

A physiological study of soft scald in Jonathan apples.

J. agric. Res., 1940, **60** : 183-92, bibl. 12.

The experiments reported here took place in the cold storage rooms of the Arlington Experiment Farm, Virginia, on Jonathan apples. Apples were stored either immediately at 32° and 36° F. or at these temperatures, after initial delays of 3 to 11 days at 65° to 75° F, or thirdly with these delays followed by a CO₂ or heat treatment prior to storing at 32° F. Fruit stored at once generally evolved acetaldehyde in small but slowly increasing amounts, whereas a delay at 65°-75° F. greatly increased the amount of acetaldehyde in the early part of the storage life. When CO₂ was given after the delay the acetaldehyde content of the fruit increased. The delay tended to increase sucrose and total sugar content of juice and pulp at the beginning of storage. CO₂ treatment had little effect on this. Delay reduced the acidity of the juice at the beginning of storage, while CO₂ had no immediate additional effect, and actually led to a slightly lower acidity in the middle of the storage period. Heating to 98.6-104° F. for 1 day after an 11-day delay at 70° F. lowered total acidity and hydrogen-ion concentration. The lot of fruit so treated showed less soft scald but more internal breakdown than the other lots. No correlation was found between the changes in sugar, acid and acetaldehyde and the occurrence of soft scald.

1223. BEARE, J. A. 664.85.11 : 632.19

Superficial scald in Granny Smith apples.

J. Dep. Agric. S. Aust., 1939, **43** : 403-5, bibl. 3.

In an experiment to demonstrate the effect of late picking, sweating and oiled papers on the control of scald on Granny Smith apples the following results were obtained. The only completely effective treatment was the use of oiled paper wraps. The oiled paper was used either as a wrapping or shredded and distributed between the layers. The percentages of superficial scald were—unwrapped 82.3, unwrapped but with shredded oiled paper between the layers 3.8, oiled sulphite wraps 1.3, plain sulphite wraps 61.4. Untreated fruit developed mould on the scalded areas and became practically useless.

1224. WORMALD, H. 664.85.11 : 632.42

Storage scab of apples.

Gdnrs' Chron., 1940, **107** : 257.

Storage scab, it is found, may occur on gas-stored fruit as well as in ordinary cold storage. The storage scab spots can be distinguished from those of ordinary scab though produced by the same fungus, *Venturia inaequalis*, being (1) darker (sometimes pitch-black), circular and usually concave or (2) smaller, superficial, dark brown spots with irregular or lobed margins, or (3) very small only just visible dot-like spots. The large spots (a) are superficially like the functional disorder known as "lenticel spotting". Control measures are (1) the ordinary routine spraying against scab with bordeaux mixture or lime-sulphur followed if necessary by a colloidal sulphur or a sulphur dust, (2) the avoidance of storing fruit when wet.

1225. HANSEN, E., AND CHRISTENSEN, B. E. 547.313.2 : 664.85.11 + 664.85.13
Chemical determination of ethylene in the emanations from apples and pears.
Bot. Gaz., 1939, 101 : 403-9, bibl. 8.

A chemical method based upon a bromination procedure has been adapted for determining the ethylene contained in the emanations from apples and pears. Solubility tests have shown that ethylene is the active gas evolved from the fruits used. Similar unsaturated hydrocarbon gases such as acetylene, propylene, and butylene were not found to be present in amounts that could be detected by the bromination procedure used. The amounts of ethylene produced by several varieties of apples and pears during ripening were determined and found to be within a range of <0.001 to 0.280 ml. per kg.-hour. [Authors' summary.]

1226. ROUX, E. R. 664.85.25 + 664.85.22
Respiration and maturity in peaches and plums.
Ann. Bot., Lond., 1940, 4 : 317-27, bibl. 9.

The fruits used in these S. African experiments were Peregrine peaches and Kelsey plums. The author summarizes as follows :—The CO₂ respiration at 25° C. of peaches and plums picked at intervals during growth was determined. It is shown that in both cases the very young fruits have an early and pronounced climacteric. Fruits of intermediate age have a very much delayed climacteric and exhibit maximum longevity in store. The stage of maximum length of storage life coincides with the beginning of the period of most rapid increase in size of the fruit on the tree. There is an inverse relation between longevity and rate of respiration. The nature of the respiratory climacteric is discussed.

1227. LLOYD, J. W. 664.85.25.037
Precooling rail shipments of Illinois peaches with special reference to the use of ventilated packages.
Bull. Ill. agric. Exp. Stat. 455, 1939, pp. 511-44, bibl. 6.

Tests with eight carloads of Illinois peaches made at the Illinois agricultural research station in 1935 and 1937 led to the following conclusions :—Precooling can be recommended as a general practice for rail shipments. For rapid precooling, the fruit should be packed in ventilated containers equipped with the new type of ventilated liners. Even for rail-shipped peaches that are not precooled the use of ventilated packages is desirable owing to the more rapid refrigeration which these packages permit.

1228. (i) ALLEN, F. W. 664.85.23.035.1 + 664.85.22.035.1 + 664.85.25.035.1 + 664.85.13.035.1
Carbon dioxide investigations : influence of carbon dioxide atmospheres upon cherries, plums, peaches and pears under simulated transit conditions.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 467-72, bibl. 4.

- (ii) ALLEN, F. W. 664.85.13.035.1
Influence of carbon dioxide in lengthening the life of Bartlett pears.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 473-8, bibl. 3.

(i) In trials at Davis, California, cherries, plums, peaches and pears were exposed for 2, 5, or 10 days at 45° F. and other temperatures to concentrations of CO₂ of 10, 20, 40 and 60% and the effect was noted. Holding in atmospheres of 10-60% CO₂ for a 10-day period definitely retarded colouring and softening not only during but also after the period. These and previous experiments would appear to establish definitely the value under transit conditions of an atmosphere containing 10 to 20% CO₂ with perhaps 16% O₂.

(ii) Bartlett pears were held under different conditions of atmosphere and temperature and results compared. Results largely confirmed those of other workers. Thus pears held 5 to 6 weeks in CO₂ at 45° F. were comparable to those held in air at 36° F. When held at similar temperatures the CO₂-O₂ combinations used have more or less doubled the normal storage life of fruit kept in air. A concentration of 10% CO₂ is perhaps the optimum, but where the O₂ was reduced only in like amount this was not so effective in retarding colouring at 45° and at 36° F. as the 10% CO₂-5% O₂ or even 5% CO₂-2.5% O₂ combinations. Fruit held in N without CO₂ and with only 2.5% O₂ was delayed in ripening but at each temperature consistently ripened in advance of the fruit held in the presence of CO₂ and eventually broke down, scalded or developed a poor flavour.

1229. WINTER, J. D. 664.85.75.037 + 664.85.711.037

Strawberry and raspberry varieties for freezing storage.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 579-82.

Of 19 varieties of strawberry and 10 varieties of raspberry tested, Beaver, Culver, Dorsett, Gem and Wayzata strawberries and Chief, Latham and Viking red raspberry were found to be the most satisfactory for dessert use after 6-10 months' storage at approx. -10° F.

1230. WINTER, J. D., LANDON, R. H., AND ALDERMAN, W. H. 664.85.75.035.1 + 664.85.771.035.1

Use of CO₂ to retard the development of decay in strawberries and raspberries.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 583-8, bibl. 3.

It was found possible to extend the time that red raspberries and strawberries could be held in good market condition by treating the fruit with CO₂ at temperatures of 55 to 60° F., relative humidity 80 to 90%. An initial concentration of 30% CO₂ was found most practicable and no advantage was got from using a constantly maintained concentration of the gas.

1231. MARTIN, W. E., HILGEMAN, R. H., AND SMITH, J. G. 664.85.323

Grapefruit storage studies in Arizona.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37: 529-34, bibl. 3.

These studies were made at Phoenix, Arizona, to determine the comparative storability of Marsh grapefruit grown in several districts, soil types and conditions. The physical and chemical changes occurring in the fruit during storage are discussed. It was found that all lots of fruit tested picked between late December and late March stored satisfactorily for 3 months under the conditions of storage, viz. 60° F. and relative humidity of 88%. The effect of wax treatment was to prolong storage life by reducing shrinkage. Also such fruit retained its colour better after removal from store and retained its flavour better than unwaxed fruit. Fruit harvested after the end of March, i.e. in the spring flush of growth, did not store so well.

1232. MILLER, E. V., WINSTON, J. R., AND FISHER, D. F. 664.85.3.035.1 : 547.313.2

Production of epinasty by emanations from normal and decaying citrus fruits and from *Penicillium digitatum*.

J. agric. Res., 1940, 60: 269-77, bibl. 13.

Oranges, tangerines, limes, lemons, and grapefruit grown in Florida produced epinasty in potted tomato, potato or sunflower plant or potato cutting in water enclosed with them in a 5-gallon wide-mouthed, stoppered bottle containing potassium hydroxide pellets to absorb the CO₂ produced by the fruit. This indicated the presence of ethylene in their emanations. Oranges and grapefruit inoculated with *Penicillium digitatum* and oranges showing stem end decay (*Diplodia natalensis* and *Diaporthe citri*) gave the same results but more quickly. Positive results were also obtained from pure cultures of *P. digitatum* but not from those of the other fungi named above.

1233. BIALE, J. B. 664.85.334 : 631.547.6

Effect of vapors from moldy fruits on colouring and respiration of lemons.

Calif. Citrogr., 1940, 25: 186, 212.

From investigations carried out at the California College of Agriculture it was found that the vapours of a single lemon infected with green mould (*Penicillium digitatum*) bring about a more rapid respiration of 50-60 green lemons, hasten colour development and cause shedding of buttons. Blue mould (*P. italicum*), sour rot (*Oöspora*) and cottony rot (*Sclerotinia sclerotum*) had little or no effect. These same effects are caused by ethylene gas, but whether this is the active substance given off by green mould has yet to be determined.

1234. VAN DER PLANK, J. E., RATTRAY, J. M., AND VAN WYK, G. F. 664.85.3.038

The use of wraps containing o-phenylphenol for citrus fruits.

J. Pomol., 1940, 18: 135-44, bibl. 4.

Tests with S. African citrus fruit show that the amounts of o-phenylphenol which can be safely used are considerably less than those found safe in Tomkins' experiments [*Rep. Fd Invest. Bd.*

Lond., for 1936, p. 149; *H.A.*, 7:147, and *Ibidem* for 1938, p. 186; *H.A.*, 10:364]. The authors sum up as follows:—Wraps containing *o*-phenylphenol significantly reduced the infection of citrus fruits by *Penicillium digitatum*, *P. italicum* and *Trichoderma lignorum* in standard commercial packs, but tended strongly to injure the rind when too much of the preservative was used. Lemons are less easily injured than oranges, and it is possible to use enough *o*-phenylphenol to ensure effective control of decay. With 9 mg. of *o*-phenylphenol per sq. ft. of wrap (0.44% of the paper weight), which is about the most that can be tolerated, infection of an extensive series of commercial consignments of lemons by *P. digitatum* was reduced by an average of 87%. Even as little as 5 mg. per sq. ft. reduced infection by one-half. Impregnated wraps are less suitable for oranges because of their greater tendency to cause injury. If glyceride oils are added to the wrap, more *o*-phenylphenol can be used without causing injury. The presence of the oil does not significantly affect the potency of the preservative.

1235. AGRICULTURAL ADVISERS TO SECRETARY OF STATE.

664.84 + 664.85

The storage of foodstuffs in the Colonial Empire.

E. Afr. agric. J., 1940, 5: 446-59, bibl. 11.

Most of the information, where it is not general, is concerned with grain. There are, however, some notes on the storage of yams, cassava and sweet potatoes. Yams can be left in the ground and used as required as in West Africa, but the usual practice is to lift as soon as ripe, full ripeness being essential to successful storage. This stage is reached when the foliage dries. After careful lifting, for bruised tubers do not store well, the yams are left exposed for a few hours and then stored 3 or 4 layers deep on shelves in an airy and cool, shaded chamber. They can also be stored in carefully packed heaps in weather-proof buildings or in pits. If in pits the soil must be dry and remain so. Under all conditions regular inspection is needed to remove diseased tubers and to rub off any sprouting eyes. Yams will keep several months under these conditions. There are varietal differences in length of successful storage period. *Cassava* is best left in the ground and dug as required; it will keep thus for several months. If cassava must be dug, as in wet or insufficiently drained districts, it may be stored in the form of dried chips or meal. When required the chips are pounded and sieved to remove fibre. *Sweet potatoes* should undergo a preliminary curing at 80-85° F. followed by storage in specially constructed stores. Where these methods are not possible—and they seldom are—the potatoes may be successfully stored for about 2 months in circular clamps covered with trash and a top layer of soil. The red-skinned types store better than the yellow and white. The variety Black Rock (Trinidad) has a reputation for long storage.

1236. WARDLAW, C. W., AND LEONARD, E. R.

664.85.771

Studies in tropical fruits. IX. The respiration of bananas during ripening at tropical temperatures.

Ann. Bot., Lond., 1940, 4: 269-315, bibl. 43. *

The authors continue their studies on the storage of tropical fruits with a very thorough examination into the respiration of bananas during ripening at tropical temperatures. They deal with the subject under the following heads:—respiration of bananas during ripening at 85° F.; relation of transpiration to respiration; internal concentrations of carbon dioxide and oxygen during ripening; internal pressures during ripening; carbon dioxide content of tissues; temperature changes of tissues during ripening; aspects of ripening in the banana, viz. initiation of ripening and progress of ripening are related to organography of the fruit.

1237. WARDLAW, C. W.

664.85.771.035.1

Preliminary observations on the refrigerated gas storage of Gros Michel bananas.

Mem. imp. Coll. trop. Agric. Trin. 15, 1940, pp. 43, bibl. 14.

1. An account is given of preliminary experiments on the refrigerated gas storage of Gros Michel bananas. 2. Observations have been made on the retardation of ripening effected in "heavy $\frac{3}{4}$ -full" fruit by different supplied gas mixtures, and by artificial atmospheres produced by restricted ventilation. The rates of accumulation of CO₂ and depletion of O₂ in closed fruit containers under different conditions have also been investigated. 3. In "heavy $\frac{3}{4}$ -full" fruit, rapidly cooled to 53° F. and held at that temperature for 20 days, gas mixtures containing 5%

CO₂ and 7 to 12% O₂, supplied from cylinders, produced a notable retardation of ripening without injurious effects, the best results being obtained at the lower O₂ concentration. As compared with the control fruit in air in which severe chilling injury was sustained, the gas-stored fruit ripened well. 4. In "heavy $\frac{3}{4}$ -full" fruit, rapidly cooled to 53° F., a definite retardation of ripening was achieved by storage in O₂ concentrations of 6 and 12% (in N₂) supplied from cylinders. Ripening data, however, indicate that for heavy grades of fruit a reduction in O₂ concentration from 21% to 12% does not afford an adequate retardation of ripening during cold storage, whereas a reduction to 6% affords good retardation without injurious effects. 5. Conclusive evidence has been obtained that where incipient ripening has already taken place, refrigerated gas storage does not retard ripening sufficiently for practical purposes. Fruit showing incipient ripening or liable to commence ripening soon after harvesting should not be accepted for refrigerated gas storage. 6. Gas mixtures containing 10% CO₂ and 8 to 12% O₂ failed to retard the ripening of "full" fruit (already showing incipient ripening) at 53° F., but no evidence of CO₂ injury, internal or external, was observed. 7. Observation of the internal concentrations of CO₂ and O₂ in fruits affords a valuable means of following ripening changes and also of assessing the normality of the changes observed. 8. It may be anticipated that, in arriving at a suitable artificial atmosphere for bananas, use will be made of the changes in atmospheric composition which result from respiratory processes, i.e. an increase in CO₂ and decrease in O₂. Experiments are described which throw light on this aspect. 9. Whether at tropical temperatures or during rapid cooling to 53° F., the accumulation of CO₂ and depletion of O₂ take place rapidly in closed containers where the ratio, volume of fruit/volume of container, is approximately 0.3 as on shipboard. It is shown, in fact, that refrigerated gas storage conditions could be achieved in the course of the first or second day from loading, provided gas leakage was negligible. 10. Under conditions of rapid cooling from tropical temperatures to 53° F., with CO₂ accumulation and O₂ depletion in closed containers, the respiration rate falls off rapidly from an initial value of 35 to 40 mg./kg./hr. to 8 to 10 mg./kg./hr. Under such refrigerated gas storage conditions the rate of liberation of CO₂ is only slightly affected by the composition of the atmosphere over a comparatively wide range of CO₂ and O₂ concentrations. 11. In fruit subjected to gas storage conditions involving a concentration of CO₂ higher than that of normal air, there is an increase in the CO₂ content of the tissues, but, on returning such fruit to air, the CO₂ escapes rapidly. 12. The effects on the composition of the storage atmosphere of removing excess CO₂ by ventilation and by chemical treatment are compared: it is shown that whereas the former procedure tends to increase the concentration of O₂, the latter tends to decrease it, but that by a suitable combination of the two methods it should be possible to keep the artificial atmosphere at approximately the constant composition desired. It may, in fact, be anticipated that in commercial practice, the gas storage of bananas, as of other fruits, will be achieved by a system of restricted ventilation in conjunction with the removal of excess CO₂ by chemical means. 13. Several experiments are described in which gas storage at 53° F. was achieved by the method of restricted ventilation, i.e. by drawing air slowly (or intermittently) through containers charged with fruit. 14. In an atmosphere containing 6% CO₂ and 14.5% O₂ "heavy $\frac{3}{4}$ -full" fruit was satisfactorily held at 53° F. for 20 days. On removal to air in the ripening room at 68° F., the fruit was still quite green, and subsequently ripened to a product of good appearance, texture, flavour and bouquet, quite free from any trace of chilling. That artificial atmospheres, which would be advantageous in banana storage, can be obtained by restricted ventilation alone is evident from the data submitted. 15. In an experiment on the gas storage of "full" fruit by restricted ventilation, the presence of fingers showing incipient ripening caused an acceleration of ripening in the aggregate of fruit in the container. Occasional bunches which have ripened during commercial gas storage should be rejected on being removed from the holds as their poor flavour, which would not be anticipated from their appearance, would be harmful to the Trade. 16. Evidence of "gas injury" was observed in fruit which had occasionally been subjected to high concentrations of CO₂ and low concentrations of O₂. The skin of affected fruits became profusely freckled with minute, non-sunken, greyish brown spots, this being accompanied by a slight greyish darkening of the skin. 17. The application of the results so far obtained to practical conditions and an outline of future investigations are briefly considered. 18. Collectively, the data obtained indicate that by using rapid cooling in conjunction with artificial atmospheres containing approximately 5% CO₂ and 5.7% O₂, it should be

possible to effect the overseas transport, during a voyage period of at least 16 days, of a grade of Gros Michel fruit considerably heavier than " $\frac{3}{4}$ -full" and even surpassing "heavy $\frac{3}{4}$ -full" from certain environments. [From author's summary.]

1238. KARMARKAR, D. V., AND JOSHI, B. M.

664.85.037

Cold storage of Indian fruits.

Indian Fmg. 1940, 1 : 173-7.

The problems associated with the cold storage of fruits, especially of tropical fruit, are surveyed and the work being done thereon in India is mentioned. Of 28 varieties of mango tested only 6 were found to keep well in cold storage; fortunately one was the popular Alphonso. When fully developed but still green and hard the fruit kept at 45-48° F. for 7 weeks and could then be ripened at ordinary temperature. Symptoms of chilling in the mango, which is easily affected, are change in colour, development of pits and sunken areas on the skin, failure to ripen and a tendency to rot after removal from cold storage. Ripe yellow fruit turns brown at 52° F. and below; green fruit chills slightly under 45° and severely at 35° F. *Gloeosporium Mangiferae* was the fungus responsible for most of the rot in certain recent experiments and it can appear as stem-end rot, lateral rot, watery rot and brown patches. Pre-storage treatment by washing or smearing with antiseptics could not prevent the disease but the plant must be in a physiological condition offering little resistance. For instance at 45° F. there is very little rotting with fruit of high acidity. Green fruit showed physiological breakdown after 9 weeks of storage at 45° F. and the pulp round the stone turned dark brown. Nagpur orange or *santra*, a loose skinned orange of the mandarin type, kept in condition when yellow or fully ripe but not having completely changed colour for from 10 to 12 weeks at 40° F., storage life ending by internal breakdown. Kept a similar time at 52° F. the pulp dried up but the external appearance remained good, a uniform golden colour having developed after 2 weeks. When stored at 52° F. for a fortnight and then at 40° F. the storage life was extended but the juice content was reduced. Borax treatment was, if anything, harmful. The *mosambi*, Mosambique orange, less full flavoured and acidic than *santra*, kept in good condition for 4 months at 52° F. and for 5 months at 40° F. The Malta orange when ripe kept for 4 months at 40° F., but the best results were always with the bigger fruits. Small fruits shrivelled and took on a dull appearance. The Assam orange rotted easily, the rot starting from the brown specks normally present on the skin of this variety. At 35° F. the loss was fairly slow and fruit could be kept for about 6 weeks. Bananas. The 500 differently named varieties of Madras were largely identical types but after elimination 50-60 distinct types remain. The best of these were tested in storage and found to chill at 52-56° F. according to variety. Chikoo (*Achras Zapota* L.) when unripe chilled at 45° F. but would ripen and hold for 5 weeks at 52-56° F. Fruit already ripe kept for 6 weeks at 32° and 35° F. Litchi kept for 3 months at 30-45° F., but the red shell turned brown. Delicious apples from the United Provinces research station at Chaubattia kept well for over 8 months at 32° and 35° F. This variety keeps poorly at normal temperature. Peaches kept for a month to 6 weeks at 32° and 35° F. Williams pears from Kashmir kept for 3 months at 32° F. and ripened during storage.

1239. JOSLYN, M. A., AND BEDFORD, C. L.

664.84.31.037

Enzyme activity in frozen vegetables. Asparagus.

Industr. Engng Chem. (Industrial edition), 1940, 32 : 702-6, bibl. 21.

Scalding asparagus for 4 minutes at 92° C. or for 3 minutes in boiling water prior to freezing resulted in retention of flavour.

1240. WELLMAN, R.

634.11-2.48

Studies on the control of blue-mold decay of apples (*Penicillium expansum*).

Res. Stud. St. Coll. Wash., 1939, 7 : 157-8.

BRATLEY, C. O.

664.85.322 : 577.16

Loss of ascorbic acid from tangerines during storage on the market.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 526-8, bibl. 2.

APPLEMAN, D., AND RICHARDS, A. V.

634.31 : 581.192

Variability of sugar-acid ratio and total nitrogen in Valencia oranges.

Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 539-42, bibl. 1.

BIALE, J. B., AND SHEPHERD, A. D.

634.31 : 581.192

Identification of acetaldehyde among the volatile products of citrus fruits.*Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 543-7, bibl. 5.***PACKING, PROCESSING AND PLANT PRODUCTS.**

1241. RICH, A. C.

634.11-1.564

Fruit injuries resulting from improper packing.*Proc. 35th annu. Meeting Washington St. hort. Ass. 1939, Wenatchee, Wash., 1940, pp. 148-51.*

A survey of boxed apples by the Horticultural Inspection Service in U.S.A. following complaints of bruising and decay in Washington boxed apples revealed that the principal factors involved in serious bruising were (1) degree of ripeness; (2) lack of uniformity of fruit size within the box; (3) poor placement in the pack; (4) presence of water-core; (5) mixing long and round types; (6) absence of pads or liners at top and bottom. Looseness of pack was often caused through an attempt to pack a given weight per box irrespective of the size of apple. Apples packed with calyx end against the lid suffered more from bruising than those with stem end against the lid.

1242. ALLWRIGHT, W.

634.3-1.564

The wiring of citrus boxes.*Citrus Gr, 1940, No. 74, pp. 5-12.*

The author, after noting that earlier wiring experiments with citrus boxes were disappointing, gives an account of more recent S. African trials in 1939. He describes in great detail the exact dimensions, type of material used, method of wiring adopted and results shown in the condition of fruit boxes on arrival in England. He comes to the conclusion that the use of wire instead of strapping for binding citrus boxes would (1) almost entirely eliminate the present danger to those handling the boxes from jagged ends and broken strapping, (2) eliminate the labour necessary for preliminary strapping and reduce the amount of labour necessary for lid strapping, and (3) result in a saving in cost of material. These successful results are subject to the boxes being made up according to a particular simple schedule which is explained in detail. The wire should be 16 gauge round wire or number 130 French oval wire or No. 4 Gerrard oval wire with a breaking strain of not less than 350 lb. It should be put on in the manner specified and suitable wire-tying machines must be used.

1243. NÈGRE, E.

663.257.3

Sur le collage des vins. (The clarification of wines.)*Ann. Éc. Agric. Montpellier, 1939, 25 : 279-94.*

The author deals with clarification by chemical methods using the following materials :—blood, gelatin, casein, white of egg.

1244. VOGT, S.

663.25

Das Schwefeln der Weine und Obstweine. (The sulphuring of wines and fruit juices.) [English, French and Spanish summaries.]*Nachr. SchädlBekämpf, 1939, 14 : 51-6.*

The different methods of sulphuring are described, and their relative merits and demerits considered. A new German apparatus (Sulfavin) is described by which pure liquified sulphurous acid is filled into ampoules of light metal each containing 25 gm. SO₂.

1245. FLANZY, M., AND THÉRON, L.

663.25 : 581.192

Le manganèse dans les vins de *Vitis vinifera* et les vins d'hybrides. (Manganese in wine from *vinifera* and from hybrid grapes.)*Ann. Tech. agric., 1938, 1 : 67-76, bibl. 16.*

Preliminary trials indicate that the wines made from direct producers such as Othello, Noah, Herbmont, Clinton, contain appreciably more manganese than wines from pure *vinifera* grapes. Although the preliminary nature of these trials is stressed and further exact trials are necessary, there seem grounds for supposing that a simple means for detecting fraud in wines may soon be available.

1246. CHARLEY, V. L. S.

663.3

The retention of natural sweetness in cider.*A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 109-15, bibl. 4.*

In war sugar is scarce and the process known as "checked fermentation" in which an appreciable percentage of the natural fruit sugar is retained in the cider will obviously ease the situation. The present article is an expansion of articles either broadcast or published in the autumn of 1939 dealing with the process together with an explanation of general principles involved and allusions to experiments carried out on the subject at Long Ashton last winter. After discussing general principles the author considers in turn the following methods of fermentation control:—racking, the use of sulphur dioxide, centrifugation, filtration. Among special precautions noted are the necessity for rendering all reception vessels thoroughly sterile, and for regular inspection of the gravity of the cider and the ullage in the casks and necessary action, which consists in checking the fermentation once again or filling up the casks to full capacity. Finally the process of determining SO_2 in cider is described.

1247. CHARLEY, V. L. S., AND REAVELL, B. N.

663.813

Concentration of fruit juices. A description of the early work at Bristol.*Food, 1939, 8: 427-32.*

The two authors describe here a vacuum evaporation plant and the experimental commercial work carried out upon it on the storage of juice in concentrated form at Carter's factory at Ashton Gate, Bristol. Since the work here described the experimental plant has been elaborated, but the essentials, which are of the greatest importance to fruits of such fugitive flavours as strawberries and the like, remain unaltered. The chief advantage of concentration is the saving in storage space and apparatus; thus 100 gallons of fresh juice become 170 gallons of syrup for storage, but only 10 gallons as concentrate. These concentrates are, moreover, much less predisposed to fermentation than the syrup type of product. Concentration is accused of imparting a cooked taste to the juice and of depriving it of the true juice aroma. Observations show that the public does not object so much to a slightly cooked taste in the juices in concentrates of such fruits as are customarily eaten cooked, e.g. in apple juice or in black currant juice, but such a taste in strawberry products is strongly deplored. The plant at Bristol was the first of its type built for concentrating juice and recovering the flavouring matter. The first stage involves the stripping of the volatile flavouring bodies and the second the concentration of the stripped juice. They occur consecutively on the Kestner plant used and the processes are here described in detail with notes on the recovery of esters and on the nature of stripping. Special attention was given to strawberries, raspberries and black currants and the effect of particular treatment on the flavour of the different concentrates. The results of the storage tests of the concentrates indicate that acidity is a most important factor. The strawberry product appeared to be stable with a sugar content of 63% by weight, but raspberry and black currant concentrates kept well in glass storage vessels with only 60% sugar content. If commercial storage vessels are not quite so safe as tightly sealed glass jars a safety margin should be allowed, and it seems that a content of 65% sugar for all concentrates would be safe for bulk commercial storage.

1248. CHARLEY, V. L. S.

663.813:634.11

Concentrated fruit juice products with special reference to the apple.*A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 116-26, bibl. 6.*

The author briefly notes the principles on which concentration is carried out by hot treatment consisting of evaporation in vacuo. Two types of vacuum concentration are used: the first consists of a vacuum pan in which the juice is heated by a calandria system under a vacuum of about 27"-28". The other type which has certain advantages is known as the Climbing Film Evaporator. Details are given of the scheme devised by the Long Ashton Station during the war of 1914-18 for the concentration of apple juice and its conversion into a form of jelly. Full details are given in the report of the station for 1917, and only the chief points of interest in the present war emergency are noted here. More recent investigations at Long Ashton, 1935-40, show that concentrates can be made from soft fruits and apples with satisfactory retention of fruit character and freedom from fermentation. Full details of the concentration processes are given in *Food* 1939, 8: 427-32. Investigations undertaken in autumn 1939 showed that most

attractive apple juice concentrates, "treacle" and jelly could be made from fruit of mediocre quality. Among other problems investigated were those connected with pectin content and removal, with clarification, collection and return of volatile constituents, with procedure for blending, and with the addition of sugar. A scheme was devised by the author for the commercial processing of the 1939 apple crop. Although this was not adopted the scheme still exists and could be worked at short notice. Some of its details are given here.

1249. SILLS, V. E. 663.813 : 577.16

The preservation of vitamin C in English fruit juices and syrups. I. The effect of preservatives, pasteurization and sugar concentration on the indophenol reducing capacity of strawberry and black currant juices and syrups.

A. R. Long Ashton agric. hort. Res. Stat. 1939, 1940, pp. 127-38, bibl. 7.

1. A method for the determination of indophenol reducing power of English soft fruit juices and syrups containing sulphur dioxide is described. 2. Fresh fruit juices of strawberry and black currant were treated and bottled as follows:—Untreated; 350 p.p.m. sulphur dioxide added; 600 p.p.m. benzoic acid added; pasteurized at 160° F. for 30 minutes. A similar series of syrups of 50° Brix strength and an untreated portion of 65° Brix strength were also prepared. The rate of loss of indophenol reducing power was followed in each treatment over a period of 13 to 14 months of storage. 3. Sulphur dioxide exerted the greatest preservative action on anti-scorbutic potency. 4. The effects of benzoic acid and pasteurization were very similar and afforded no definite preservative action on antiscorbutic potency. 5. High sugar concentration exerted a preservative effect on antiscorbutic potency, but less than that of sulphur dioxide. [Author's summary.]

1250. BATES, G. R. 664.85.31

Recent developments in the processing of Rhodesian oranges.

Reprinted from *Proc. Rhod. sci. Assoc.*, 1939, 37 : 29-35.

Present-day Rhodesian methods of handling, colouring and packing oranges are described as well as various treatments used for the prevention of mould decay in transit.

1251. CRANG, B. A., AND MASON, M. 664.85 + 664.84

Preserves from the garden.

"Gowmore" Bull. Minist. Agric. Lond. 3, 1940, pp. 30, 4d.

The householder who is determined to make the most of his home-grown food supplies, especially during the present phase of incomplete tranquillity, must buy this bulletin. Practical details are given on the following processes:—the making of jams, fruit jellies and cheeses; bottling and canning of fruit; pulping and chemical preservation (including the use of the Campden process); fruit syrups; canning and bottling of vegetables; chutneys; pickles; drying of fruit, vegetables and herbs; salting of beans.

1252. CIDRAIS, J. 664.85

A aproveitamento e a conservação da fruta. (Fruit preservation.)

Ser. Divulgação Minist. Agric. Lisboa 9, 1937, pp. 23.

Practical advice on fruit preservation in the natural state or by bottling.

1253. HULL, R. 664.85.036.5 : 632.4

Study of *Byssoschlamys fulva* and control measures in processed fruits.

Ann. appl. Biol., 1939, 26 : 800-22, bibl. 11.

A survey of various fruit-producing areas in England showed that fruit and foliage were liable to be contaminated with ascospores of *Byssoschlamys fulva*. Contamination was most pronounced on mummified plums and on certain fruit refuse. The thermal death point of ascospores is about 96° C., but only a small proportion of spores show this maximum heat resistance. Conidia are killed by exposure to relatively low temperatures. The reaction and the sucrose concentration of the heating medium, and the strain of the fungus are factors influencing the heat resistance of ascospores. Ascospores germinate slowly and irregularly, but their germination is stimulated by previous heating to about 70° C. Ascospore germination and mycelial growth take place at relatively high temperatures, in high sucrose concentrations, in acid media, and in very high concentrations of carbon dioxide. Ascospores are relatively insensitive to antiseptics and to

desiccation. Growth is accompanied by the production of a pectin-destroying enzyme. The results of laboratory experiments were applied to canning experiments and good agreement was obtained. Natural contamination on fruits could be overcome in cans by heating the contents to 195° F. The amount of mycelial growth developing in an infected can depends upon the size of headspace and the storage temperature. [Author's summary.]

1254. KERTESZ, Z. I., TOLMAN, T. G., LOCONTI, J. D., AND RUYLE, E. H.

664.84.64.036.5

The use of calcium in the commercial canning of whole tomatoes.

Tech. Bull. N. York agric. Exp. Stat. Geneva 252, 1940, pp. 22, bibl. 6.

The treatment of whole tomatoes with calcium salts has been found to improve the firmness of the canned product. Three methods, namely treatment with calcium chloride before canning, addition to the cans of calcium chloride dissolved in tomato juice, and incorporation in salt tablets, were tested at Geneva in 1939. There are indications that dipping peeled tomatoes into a 2% solution of calcium chloride for 2-3 minutes at room temperature will normally suffice to improve their firmness in the can. The following amounts are suggested for direct incorporation in the can :—for firm fruits 7½ grains, soft fruits 10 grains and very soft fruits 12½ grains of calcium chloride for a No. 2 size can. These quantities can also be incorporated as a salt tablet. The relation between the uptake of calcium and improvement in firmness were investigated and are discussed in the light of possible commercial utilization of the method.

1255. NATIVIDADE, J. V.

665.327.3

The production of olive oil in Portugal.

Grémio dos Exporadores de Azeite (Corporation of Olive Oil Exporters), Oporto, 1939, pp. 56.

This well-illustrated publication is issued by the Corporation of Olive Oil Exporters of Portugal, a body to which all local olive oil exporters must belong, and which is concerned with the compulsory maintenance of a high standard of oil both for the home trade and for export. The publication gives a picturesque account of the past and present methods of working in the industry and should serve as a good advertisement not only for the oil but also for the country. The author, who has published much serious scientific work, must be congratulated on his versatility in producing this romantic and graphic story.

1256. CHILD, R.

634.61 : 634.984.72

Coconut shell charcoal.

Leaflet. Coconut Res. Sch. Ceylon 6, 1940, pp. 7.

Coconut shell charcoal is one of the best absorbents for gases, etc., after it has undergone a process of activation. Estate charcoal as exported has very little absorbing power. Purchasers require a certain standard of quality and freedom from impurities that render activation more difficult. Common faults of a locally produced charcoal are :—Excess of moisture, sand or earthy matter ; insufficient burning ; the inclusion of salt due to the use of brackish water in cooling off. The leaflet gives instructions capable of being carried out locally for the preparation of charcoal which will reach the required standard. The weight of charcoal, obtained if the proper technique is carried out, should be just under 30% of the weight of the original shells. The usual standard requirements are :—*Size* : Not more than 5% to pass a ¼" mesh sieve. *Ash content* : A limit of 2%. Since clean charcoal averages 1.8% of ash, this only leaves a tolerance of 2 parts per thousand for sand, etc. *Chloride content* : A limit of 1.0 mg. per gm. *Moisture* : From 5 to 10% according to specification of purchasing form. *Volatile matter* : Usually 15% ; that is, that when heated under certain standard conditions the same shall not lose more than 15% of its weight. Should it do so it is an indication of the common fault of underburning. The leaflet concludes with a note on the manufacture of pyroligneous acid and tar from the vapours given off. This, however, is not suitable for small estates.

1257. WALKER, G.

632.951.1

Notes on pyrethrum driers.

E. Afr. agric. J., 1940, 5 : 466-9.

A system of drying pyrethrum flowers, known as the Ainabkoi system, was described *ibidem*, 1937, 2 : 327-38. This system has since been adopted by many growers in Kenya, one of whom

now submits (with drawings) a description of his labour-saving modification in changing and removing the lower trays and also describes a second method, less labour-saving but cheaper to construct, contrived on another estate.

1258. PERCHER, G. 663.25 : 581.192
 L'extrait sec des vins. (A process for determining the dry matter in wines by extraction in vacuo.)
Ann. Tech. agric., 1938, 1 : 63-6.
 OSTERWALDER, A. 663.25
 Eine neue Art Weinverbesserung. (Improving sour wines by the addition of unfermented grape juice and Tokay concentrate.)
Schweiz. Z. Obst-u. Weinb., 1940, 49 : 100-6.
 FITZGERALD, C. D. 663.3
 Further studies in the preservation of apple cider with carbon dioxide.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 479-80, bibl. 1.
 BLUMENTHAL, S., AND SEGNES, D. 634.774-1.56
 Pineapple fruit. Methods for processing its manufactured products.
Fruit Prod. J., 1940, 19 : 236, 237, 249.
 HENDRICKSON, A. H., AND VEIHMAYER, F. J. 634.22
 The effect of yields upon the apparent drying ratios of French prunes.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 178-82, bibl. 1.
 FISHER, D. V. 634.22
 A three year study of maturity indices for harvesting Italian prunes.
Proc. Amer. Soc. hort. Sci. for 1939, 1940, 37 : 183-6, bibl. 5.
 TRISTRAM, G. R. 633.912 : 581.192
 The proteins of *Hevea brasiliensis*. 1. Analysis of a product isolated from dried latex.
Biochem. J., 1940, 34 : 301-6, bibl. 19.

NOTES ON BOOKS.

1259. HOWARD, A. 631.417.2
An agricultural testament.

Oxford University Press, London, 1940, pp. 253, bibls., 15s.

In this aptly-named book, Sir Albert Howard contends, in his usual striking and provocative manner, that the salvation of the soil, the agricultural industry and finally the health of the community, from ruin, depends on restoring to the soil its "manurial rights" in the form of humus. He contrasts the natural preservation of the soil in forests and in Eastern peasant-farming methods with the rapid deterioration seen under specialized Western forms of chemical manuring and mechanical cultivation. The increased production needed for expanding populations and industries has, he says, been obtained by cashing-in the capital reserves of the soil. His solution is the return to the soil of an adequate supply of organic materials, in the form of compost. The composting method recommended is the Indore process, as described below. (See also *H.A.*, 6 : 430, and 1 : 422, 5 : 463, 8 : 922 and 9 : 199.) The most important new point is that an abundant supply of humus in the soil is found to favour a strong association of mycorrhiza with the roots of many plants. This mycorrhizal bridge supplements the root hairs ; "by means of this connexion certain soil fungi, which live on humus, are able to invade the living cells of the young roots and establish an intimate relation with the plant. . . . At the end of the partnership the root consumes the fungus, and in this manner is able to absorb the carbohydrates and proteins which the fungus obtains partly from the humus in the soil. The association, therefore, is the living bridge by which a fertile soil (one rich in humus) and the crop are directly connected and by which food materials ready for immediate use can be transferred from soil to plant." Samples of roots of many crops including banana, cacao, cardamoms, cloves, cotton, coconuts, grasses, green manure crops, hops, leguminous shade trees, rice, rubber, strawberries, sugar cane, tea, tung and vine, were examined by Drs. Rayner and Levisohn on behalf of the author, and were found to show mycorrhizal association. Experimental evidence is still rather scanty. A case is quoted of tea seedlings grown on subsoil in Ceylon from which

the humus-containing top-soil was removed (1) with humus added and (2) with artificials added. At 9 months old the seedlings on plot 1 were 10" high, and healthy; those on plot 2 were 6" high, and unhealthy. Roots of healthy plants in tea gardens were found to show mycorrhizal association; those of poor plants little or none. Numerous examples of great improvement in crop following large-scale adoption of compost applications in commercial plantations particularly in coffee, tea, sugar cane and rice, are given. Resistance to diseases of the crops and improved nutritional value, conferring resistance on the consumer, are also claimed for crops grown with adequate humus supplies. While these conclusions are based mainly on general observations rather than controlled experiments, there is little doubt that they are of great interest and importance. The Indore process makes composts in pits and heaps, requiring vegetable wastes, animal residues (including urine), bases (earth, etc.), water and air. Heaps 30 ft. \times 14 ft. are convenient, charged in 5 sections 5 ft. wide; the 6th section is left vacant for turning. A 6" layer of vegetable wastes is laid across the pit, followed by 2" of farmyard manure, and sprinkled with earth, wood ashes or limestone. This sandwich is repeated until a height of 5 ft. is attained. Three aeration holes are made, and trampling is carefully avoided. Water is added if required to keep the mass moist. Fermentation proceeds rapidly. The mass is turned after 2 or 3 weeks and again after another 3 weeks. It should be ready for use after 3 months. An interesting development used in Lincolnshire is "Sheet Composting". Beans are sown in July after a pea crop is picked. The pea haulm is immediately replaced on the soil surface, and 6 to 7 tons per acre of farmyard manure is added. The beans grow through the fermenting mass and are ploughed in in September. Another modification, used in tea plantations, is the composting of prunings and green manure plants in small pits 2 ft. \times 1½ ft. by 9" to 12" deep, between alternate rows of tea. A sandwich of green material, farmyard manure, more green material and finally 3" of earth fills the pit, which requires no further attention. Other chapters deal with soil aeration, nitrate conservation, soil erosion, green manuring and disposal of town wastes. The large humus supplies available in "controlled tips" are mentioned. In one section the author strongly criticizes the present organization of agricultural research on the grounds that there is too much specialization and fragmentation of problems. W.S.R.

1260. LAURIE, A., AND POESCH, G. H.

635.9 : 631.544

Commercial flower forcing.

Blakiston, Philadelphia, 2nd edit., 1939, pp. 557, bibls, \$4.50.

So rapid has been the progress in scientific horticulture and the adaptation of its recent discoveries to commercial practice that after only 4 years a revision of this very useful book (which originally had L. C. Chadwick as the junior author) became essential if it was to remain of value. In this edition besides minor changes and the omission of a chapter on plant structures and their function, which though interesting did not have much direct bearing on commercial technique, the latest developments are presented, not academically, but in a manner which shows the grower exactly what he must do to benefit from them. These developments include the substitution of gravel and cinders for soil, the discovery and practical application of growth promoting substances to the rooting of plants, the new ideas in soil sterilization, the control in flowering through the recently enunciated facts dealing with temperature, the modern methods of crop protection and so on. The chapter on the construction and heating of greenhouses is very complete and should enable the grower to keep a knowledgeable eye on his builder. A discussion of the factors influencing plant growth is rendered particularly valuable by the inclusion of notes on the optimum artificial lighting for various flower crops at different seasons. Certain crops such as sweet pea, *Freesia* and roses do not respond favourably to artificial light, while with pansies flower production has been increased as much as 16 times in a 3-month blooming period. For example for pansies a light intensity of five to seven foot candles provided by 40-60 watt lamps with suitable reflectors placed 18-24 inches above the plants is advised. For many other crops much lower intensities are sufficient. The chapter on fertilizers should avoid much misdirected effort and, if well digested, result in considerable economy combined with increased yield and improved quality. There is a useful table showing the optimum soil reaction in general terms and, more specifically, the soil mixture, fertilizer requirement and rate of application for 62 different varieties, bulks being here considered as a single entity. In the propagation section, in which every relevant method is considered, another table covering

15 pages gives the time of benching or forcing, time of propagation by sowing or cuttings, and special treatment, approximate time of maturity for warm house and temperate house for an even greater variety. Some of these dates are indicated merely by the appropriate American festival. St. Valentine's date, unless he is very young, the English grower, possibly with a sentimental heart flutter, will be able to recall, though nowadays it will put little in his pocket, but Mother's Day, Memorial Day, and Thanksgiving Day are likely to leave the English reader guessing.

There is a chapter on the diagnosis of the many ills to which greenhouse plants are subject and again tables of symptoms and control for each crop should make correct diagnosis a matter of minutes. Full notes on the cultivation of the major and minor flower crops occupy 200 pages and are succeeded by a chapter on cloth houses for summer culture of choice blooms. [Organized research in this direction is fairly recent and a separate abstract will be found on this chapter, see Abstr. 1106.—ED.]

The final chapters deal with wholesale marketing and costs of production, under American conditions. There are extensive bibliographies. The book can be recommended to the market grower at home and abroad with complete confidence.

1261. MARTIN, H.

632.95

The scientific principles of plant protection with special reference to chemical control.

Edward Arnold & Co., London, 1940, 3rd edit., pp. x+385, 22s. 6d.

The appearance of a new edition of this well-known text-book is opportune in that it coincides with the close of a period that has witnessed a rapid development in our knowledge of the scientific principles of pest and disease control. Current events cannot fail to result in a substantial reduction in the output and dissemination of technical and scientific literature as well as in the re-orientation of many lines of research. In recent years the trend of investigations on insecticides, fungicides, and allied materials has been in two main directions. Much effort has been devoted to establishing the means of interpreting laboratory evaluation in terms of field performance, and Dr. Martin, having played a conspicuous part in more than one phase of this development, is particularly well qualified to interpret the progress made. The search for new and improved specifics has continued though here, as judged by published work, chief credit goes to the United States. Outstanding achievements have been few, but the principles underlying the relation of chemical and physical properties to toxicity are slowly being worked out and the time is in sight when this line of work will be established on a rational basis. The history of chemotherapeutic research as applied to medicine is thus being repeated in the field of insecticides and fungicides. It is not surprising, therefore, that much of the new material in the book is to be found in the chapters devoted to these topics. The present edition fully maintains the high standard set by the earlier ones. The general arrangement and presentation remain unchanged, but both discussion and references have been brought well up to date. The author has wisely resisted the temptation to extend the scope of his treatment and has, in fact, effected his revision without adding more than a very few pages. Despite this, little work of real significance has been overlooked, nor can Dr. Martin be accused of taking a narrow view of his subject. As the sub-title implies, chemical methods of pest and disease control, to which more than half the book is devoted, receive particular attention, but not to the exclusion of other relevant topics. Biological features such as the natural resistance of plants to pests and diseases and its exploitation in horticultural practice are discussed at length, as also are methods of biological control. Environmental factors including soil, climatic conditions, and nutritional status are also dealt with. One interesting omission has been noted. In his introduction the author points out that from the plant's point of view the most noxious of all pests is Man. A close perusal of the book has failed to reveal any suggestions for control measures! H.S.

1262. MOLISCH, H. [Translator FULLING, E. H.].

575.7

The longevity of plants.

E. H. Fulling, *Botanical Review*, New York, 1938, pp. 226, bibl. 375*+107, \$3.

The original edition of this book, *Die Lebensdauer der Pflanze*, published in German in Jena in 1929, was first translated into English by E. H. Fulling, Editor of the *Botanical Review*, New

* A large number of these references refer to different pages of the same work.

York, in 1938. It is claimed by the author to be the first comprehensive study on the longevity of plants. The chapter headings give an idea of the scope of the book. These are:—The longevity of unicellular organisms; the longevity of multicellular organisms; longevity and related phenomena; the means of prolonging the life of plants; rejuvenescence; apparent death; old age, death and the alleged potential perpetual life of the tree. To the original bibliography, which is not very conveniently arranged, the translator has added 5½ pages of more recent literature on longevity and relative topics. This additional bibliography is both classified and alphabetically arranged as regards the authors and forms a very useful contribution. Subjects referred to but not mentioned by Molisch, presumably because they had not then been developed sufficiently, include iarovization [vernalization], auxin, polyploidy and sex reversal. The study of such subjects involves, of course, artificially controlled conditions in the laboratory whereas Molisch's work is concerned mainly with plants under natural conditions. This book while extremely readable and full of interesting data cannot in the light of modern research be considered as deeply scientific. The translation gives the appearance of adhering very strictly to the text, a fact which has advantages and disadvantages.

1263. QUALE, H. J.

634.3-2.617

Insects of citrus and other sub-tropical crops.

Comstock Publishing Company, Inc., Ithaca, New York, 1938, pp. 583,
bibl. in text, \$5.00.

Another great service has been rendered to the science of economic entomology by the publication of Dr. Quale's work entitled *Insects of citrus and other sub-tropical crops*. A book dealing with all the insect and mite pests of citrus has been anxiously awaited not only by specialists and growers of the United States and other citrus growing countries, but also by those associated with pest control in other parts of the world. While it may be true that the insects and mites associated with citrus, and also measures used to combat them, may not directly concern every economic entomologist of the British Commonwealth, yet it is essential to keep in touch with the workers of other fields, and for this reason alone Dr. Quale's work is of immense value. Dr. Quale has studied and specialized in the subtropical fruits in the United States and in other countries for more than thirty years and most rightly can be described as the foremost worker on citrus pests. The subject matter is divided into eighteen chapters and 377 figures accompany the text. The first chapter describes briefly the 12 different fruits included, together with a key to the citrus pests. The next two chapters deal with the major insect and mite pests which attack citrus, special reference being made to those which occur in California. Then follows a detailed list of the predacious and parasitic insects which attack the citrus and other subtropical fruit pests. Chapters 5-14 inclusive refer to the pests associated with the avocado, grape, Persian walnut, almond, pecan, fig, olive, date, oriental persimmon, pomegranate, and sweet cherry. Brief reference is made to the rodents, nematodes and snails. Control measures are outlined in two chapters entitled Fumigation, and Spraying and Dusting. The final chapter discusses domestic plant quarantine. It will be noted that, while 300 pages are devoted to citrus, only about 100 relate to the other eleven fruits discussed. The natural enemies of the pests of subtropical fruits are dealt with at considerable length, more especially those associated with citrus pests. The chapter devoted to fumigation will be of special interest to the practical man, since it covers a very wide field. It starts by giving the history of fumigation, the development, and finally the present-day usages. An unfortunate misprint appears in the last line of page 504 where dosage is considered. It should read 1920 and *not* 1930. The chapter on spraying and dusting discusses petroleum oils and sulphur, as might be expected, and only brief reference is made to such insecticides as derris, nicotine, etc. The important question of spray injury from petroleum oil sprays is discussed quite casually, but perhaps this is because so little is known about this very important aspect of fruit tree spraying. The references are contained in the text, and appear to be quite adequate. It is refreshing to find so many references to papers of other countries than the United States, which may be accounted for by the fact that the author has made contact with most citrus growing districts of the world. This work is to be strongly recommended not only to specialists and growers of subtropical fruits, but to economic entomologists, and those engaged in pest control wherever they may be. A.M.M.

1264. HATTON, R. G.

634.1/7

Landmarks in the development of scientific fruit-growing.*Agriculture in the twentieth century.* Essays presented to Sir Daniel Hall.

Clarendon Press, Oxford, 1939, pp. 309-60, 15s.

To Sir Daniel Hall, who is, but would probably hate to be called, the grand old man of agriculture—being younger in spirit and more agile in body than most of us—a symposium of fifteen articles on agricultural research, practice and organization has been presented as a tribute by a small group of his friends and disciples.

The particular article which chiefly concerns us is by the Director of the East Malling Research Station, who is pre-eminently capable of describing pomological research in which he has himself taken so large a part.

He considers that Thomas Andrew Knight with his deliberately planned horticultural experiments may rightly be regarded as the progenitor of fruit research in this country. Next, many years afterwards, came Pickering's disturbing Woburn experiments. It was not, however, till 1911 that the National Fruit and Cider Institute, founded at Long Ashton in 1903, became the Horticultural Research Institute of the University of Bristol. The John Innes Horticultural Institution also came into being in 1911, and in 1912, born of the South-Eastern Agricultural College, Wye, the East Malling Research Station.

This is no article for the dilettante's leisure hour. The author is not out to dazzle the reader with flashing phrase or exaggerated account of epoch-making discoveries. The discoveries of the horticultural scientist are startling enough but they do not emerge easily or as the result of a moment's intuition. Rather they only gradually come to light as the result of years of work and often the solution of one problem is only the beginning of another. Yet this narrative of great achievement should help and inspire the horticultural research worker of to-day. It should, moreover, prove invaluable to all who want to grasp the trend of research as applied to specific problems of the fruit-grower.

The author deals with his subject under the following headings :—*Fruit material and standardization.*—The identity and differences between varieties ; the establishment and maintenance of healthy clones ; the life cycle of the strawberry. *The "build up" of the fruit-tree.*—Propagation ; rootstocks, seedling and vegetatively raised ; measuring rootstock influence ; effects of rootstocks ; incompatibility of rootstock and scion ; the source of rootstock influence ; the layout of field experiments. *The effects of external and internal factors upon the tree.*—Pruning ; ringing ; cause of fruit bud formation ; seasonal cycles ; factors affecting flowers and fruit set ; sterility and pollination problems. *Roots of the fruit tree.*—Spread and depth ; life cycle of absorbing root-system ; effect of soil temperature and moisture. *Soils in relation to fruit-growing.*—Fruit soil surveys and their practical applications. *Nutrition.*—Pot cultures ; deficiency symptoms ; field experiments. *Direct tree injection with liquids for detection of deficiencies.*—Technique and possibilities. *Fruit and its market quality.*—Orchard factors and storage qualities ; storage atmosphere. *The fruit plant and disease.*

1265. ADRIANCE, G. W., AND BRISON, F. R.

631.53 : 634/635

Propagation of horticultural plants.

McGraw Hill Publishing Company, London, 1939, pp. 314, bibls., 20s.

This well-produced work should adequately fulfil its primary aim which is to be "a text for basic courses in horticulture and related courses". A very wide field is covered in some three hundred pages but sufficient information is given for the general student. The suggested references at the end of each chapter should facilitate the further study of subjects of particular interest. The book is up-to-date. The use of growth-controlling substances in the rooting of cuttings is described. The authors very wisely point out that treatment with these substances is not always successful and the whole matter is placed in its right perspective. The authors state in Chapter VI that the vegetative propagation of plants demands (1) production of new roots, (2) union with another plant that provides the root system. It would have been well here to mention that the production of new shoots on certain root cuttings may be a third necessity and is quite often a limiting factor with root cuttings. The essential difference between true leaf cuttings and "leaf-bud" cuttings could have been made more clear on page 128 and it

would have been well here to stress the value of leaf and leaf-bud cuttings for the rapid multiplication of newly introduced plants where such methods are practicable. It would, moreover, have been advantageous to describe the use of heeled cuttings under the heading Semi-hardwood Cuttings. Again frameworking surely deserved its mention? Dwarf apple trees are dealt with in a dozen lines and dismissed as "interesting novelties but of little commercial value". On that point the reviewer is inclined to differ. Yet these are small points and detract little from the excellence of a first rate student's text-book, concise and easy to read. The illustrations are remarkably clear and helpful.

R.J.G.

1266. NATIONAL RESEARCH COUNCIL OF CANADA.

632.184

Effect of sulphur dioxide on vegetation.

N.R.C., 815, Ottawa, 1939, pp. 447, \$15.

From the smelter at Trail, fumes, confined in the narrow valley of Columbia River, were swept by the prevailing winds southwards over the International Boundary into Washington. As metal production rose, improvements in the treatment of the smelter gases could not prevent a gradual increase in the amount of sulphur discharged to the atmosphere which, from 1926 to 1930, remained at about 9,000-10,000 short tons per month. Complaints by farmers in the affected districts of Washington of damage to their crops and forests led to the appointment of an International Joint Commission to whom, among other questions, those of the extent of damage and amount of compensation for past damage were referred. Their problems were investigated, on behalf of the Canadian Government, by the N.R.C. whose work is recorded in this Report which includes not only much of the evidence presented to the International body but also much information of scientific interest and of no direct bearing on the question of compensation. The work was at first confined to field studies in which the interest of the reader is at once fixed by the subtle methods devised to assess the extent and duration of damage, methods which rival those of even the fictional forensic investigator. The sulphur content of leaves, for example, yielded evidence to supplement that obtained by the direct estimation of atmospheric sulphur dioxide. The effects of sulphur dioxide on the sulphate content, the acidity and the base saturation of the soil were used to map the affected area. The examination of the sulphate content of the water supplies, on the other hand, was influenced too much by the nature of the parent material from which the water flowed to yield reliable evidence. The measurement of the annual rings of Douglas fir, a conifer highly susceptible to sulphur dioxide, gave evidence of the range and duration of damage in good agreement with that derived from the field survey of damage, the sulphur content of the foliage and of the atmosphere. The section on field studies is, apart from being a model of scientific investigation, of no particular interest to the horticulturist but, from this work, arose certain problems for investigation in the laboratory. In the first section, however, there is a full description of the symptoms of sulphur dioxide damage on a wide range of plants, from conifer and cereals to flowers and weeds. From this range barley and lucerne were chosen as test plants because of their great sensitivity. The general applicability of the results obtained with these two plants to other species is indicated. The plant physiologist will be thankful for the chapters devoted to the influence of environmental factors on susceptibility to damage and to the effects of sulphur dioxide on stomatal behaviour and on assimilation and respiration. The practical end-point of this work was to examine the hypothesis of "invisible injury" by sulphur dioxide concentrations below those causing visible symptoms, but these chapters alone will ensure that the Report has its place, as a classic, on the bookshelves of all interested in phytocidal action.

H.M.

1267. IMPERIAL INSTITUTE [HOLMAN, H. J., editor].

632.951

A survey of insecticide materials of vegetable origin.

Imperial Institute, London, S.W.7, 1940, pp. 155, bibl. 372, 3s. 6d.

The editor is to be congratulated on the issue of this most satisfactory notebook. For it is essentially a notebook into which anyone can dip with excellent hope of finding the source, potency and other characteristics of the more important insecticides of plant origin. He is also provided with ample references to articles dealing fully with their cultivation and chemistry. What is so surprising to the layman, however, is that, despite its content of massed facts, it is all so extremely readable, for chemical terms such as rubijervine, veratridine, etc., vie with local

names, barbasco, nekoe and others in giving colour to a sprightly text. Moreover the wider aspect of the subject is not neglected and it is noted that the producers of vegetable insecticides are likely to be faced with ever increasing competition from synthetic products. It may be possible to combine the two. Thus fly sprays of enhanced performance over that produced by either individually are available by the combination of certain synthetic materials with small amounts of pyrethrins. Again derris has not yet ousted lead arsenate in effective control of codling moth but a new synthetic product, thiodiphenylamine, has now appeared as a possible competitor. The insecticides dealt with in this work are discussed under the following headings : I. *Alkaloid-containing materials*, viz. nicotine, nicotine products, anabasine, hellebore, other alkaloids ; II. *Plants containing rotenone and allied compounds*, viz. derris, lonchocarpus, tephrosia, mundulea, other plants ; III. *Pyrethrum* ; IV. *Quassia* ; V. *Plant oils*, viz. essential oils, fatty oils, cashew nut-shell oil. In all cases except that of plant oils the botany and chemical properties of the plant in question are considered and the insecticidal effects of their extracts. Notes are given of the chief producing countries and of their production and export of the particular commodity, and more briefly of the methods of cultivation adopted as also of experimental cultivation elsewhere. As regards plant oils, essential oils have not proved comparable in efficiency to the established insecticides, but they have definite uses which are here discussed. Some of the fatty oils such as cotton seed, etc., can be used as sprays in the same way as mineral oils and are also useful as wetters or spreaders. An appendix contains the structural formulae of rotenone, sumatrol, elliptone, malaccol, deguelin, toxicarol, nicotine, anabasine, pyrethrin I and pyrethrin II.

1268. MITCHURIN, I. V. 634.1/8-1.523

Collected works. 1. Principles and methods. [Russian.]

Selkhozgiz, Moscow, 1939, pp. 655.

This is the first of four volumes to be issued shortly. It includes a few unpublished articles by the author, but there appears to be nothing new to those who are acquainted with the previous publications. Volume two dealing with pomological subjects will be also supplemented by some unpublished work. Volume three promises a certain interest, as it will include records and diaries on which most of Mitchurin's theories are based. The fourth volume will include correspondence with horticulturists and scientists.

1269. SOUTH AFRICAN CO-OP. DECIDUOUS FRUIT EXCHANGE. 634.1/7 : 382.6

Annual report of the Overseas Representative, season 1938-1939,
1939, pp. 80 (mimeographed).

Figures are given of exports of S. African deciduous fruits to Europe in the 1938-9 season. In descending value of exports the fruits run as follows :—grapes, pears, plums, apples, peaches, pineapples, apricots, nectarines, melons. Detailed notes are given of the condition of the fruit as received and of the competition sustained against fruit from other sources, notably the Argentine. Various substances, viz. sodium meta-bisulphite, alcohol, formalin and formaldehyde, were all tested for control of mould in grapes, the most successful being sodium meta-bisulphite. Since used in powder or crystalline form it appeared to involve risk of SO₂ injury to the berries, the effect was tried of spraying the woodwool packing material with an alcoholic suspension of meta-bisulphite. Results are said to warrant further extensive trials. The reception given to the wire-bound boxes for apples and pears in place of the standard Californian boxes was not very favourable.

1270. C.S.I.R., AUSTRALIA. 634.1/8 + 664.85

Thirteenth Annual Report of the Council for year 1938-39, 1940,
pp. 110, 4s. 6d.

Among items of investigation interesting to horticulturists are the following :—II. *Plant investigations*. 5. Fruit. In Tasmania a trial is being made of different atmospheres and temperatures for the storage of particular apple varieties. No success has attended attempts to reduce low temperature breakdown by pre-storage carbon dioxide treatment. In Queensland apple and pear rootstock investigations continue and the root systems of 28 own-rooted apple trees have been examined. In Irrigation Areas investigations embrace citrus rootstocks and

disease causing the death of vines, apparently physiological in origin. 7. Tobacco. Much work is in progress on disease, chemistry, physiology and smoking qualities. III. *Entomological problems*. It is concluded that sprays are unlikely to control the oriental peach moth (*Cydia molesta*) effectively and attention is being concentrated on establishing the parasite *Macrocentrus ancyliivorus*. Work on insecticides for the control of codling moth (*Cydia pomonella*) is directed to the discovery of organic compounds, synthetic and natural, to take the place of arsenicals. VII. *Irrigation settlement investigations*. At Merbein the present aim of viticultural investigation is to determine the fruiting potentialities of a vineyard in its environment, so as to produce the maximum yield consistent with satisfactory quality and proper maturation of the canes which carry the following crop. Work includes training, pruning and fertilizer trials. Fruit processing methods are being further examined. At the Irrigation Research Station (Murrumbidgee Irrigation Areas), Griffith, trials have been made on the inarching of citrus, on stock selections of rough lemon, sweet orange and sour orange and on the root systems of citrus. IX. *Food preservation investigations*. Investigations have proceeded on citrus storage spot, on the prevention of wilting by waxing, on preliminary sweating, temperature of storage and other factors affecting wastage. Investigations made in conjunction with the Victoria and New South Wales Departments of Agriculture have included storage problems of apples, pears, peaches, plums and grapes. Some preliminary work is reported on the preparation and preservation of juices from Australian oranges and pineapples. It includes investigations on can lacquers. A map is given showing the location of C.S.I.R. laboratories and field stations.

1271. D.S.I.R. LONDON.

016 : 664.84 + 664.85

Index to the literature of food investigation, Vol. 11, No. 3, December 1939, 1940, pp. 199-304 (fruits and vegetables 255-71), H.M. Stationery Office, Kingsway, London, 4s. 6d.

To those of our readers who are interested in the processing and storing of fruits we would commend this quarterly publication by the Department of Scientific and Industrial Research. Brief summaries, sometimes indeed mere abstracts of abstracts, are given in each case, but their brevity does not prevent them forming an extremely useful annotated index of recent work in the above mentioned fields.